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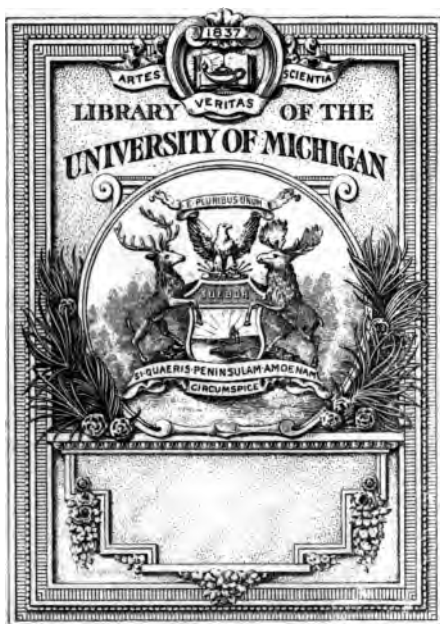
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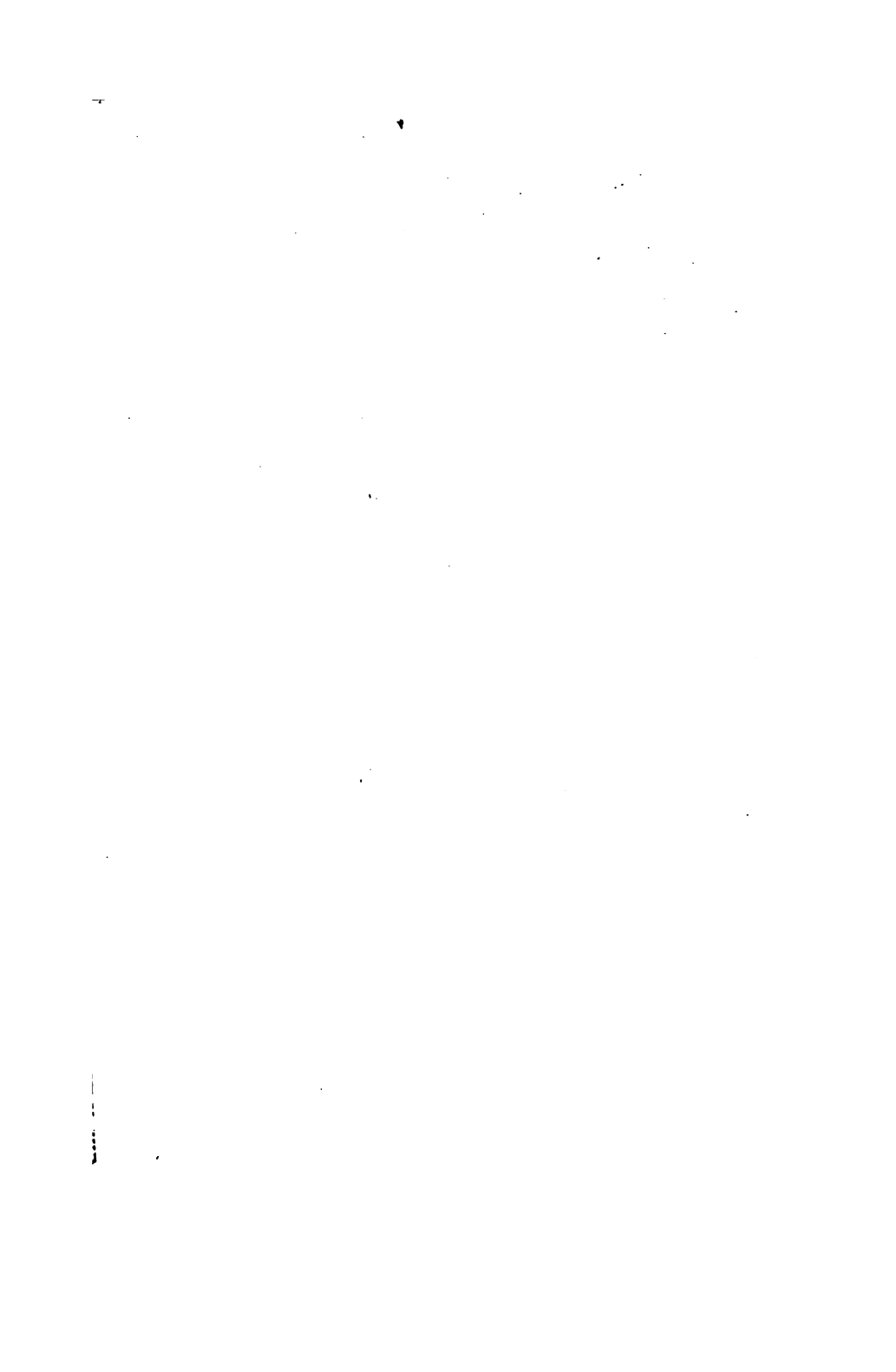
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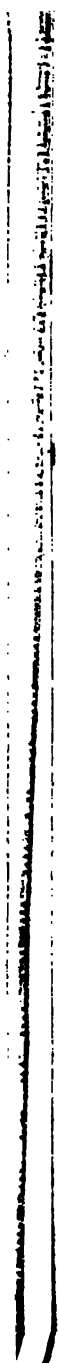
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PREFACE.

It is believed that a system of rudimental science and manual art can be adapted to the usual methods of instruction; and although the teaching of particular trades is neither desirable nor practical in school-life, yet the time has now arrived when education should give the children practical knowledge in those general principles which relate to the trades and arts that are destined to become the business of their subsequent life.

Had this book been written for those only who have specially studied the question, I should feel it necessary to apologize for so many details concerning industrial schools in Europe and the United States; but my object is to instruct the general reader, and elicit his interest by the results of experience. The mind is delighted with a logical demonstration, because it is so conclusive; but a successful example is of much more value than the most confident affirmations or deductions. This is the excuse, if one were necessary, for giving a pretty full account of these successful experiments in industrial training.

What is industrial education? What are its merits and objects, and, above all, what power does it possess of ministering to some useful purpose in the practical arts of life? Whether I have answered these questions with a reasonable degree of exactness and precision, can only be determined by a perusal of the volume.

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No discussion regarding the useful pursuits of life can take place at present without an emphatic recognition of the claims of industrial education. When we consider that all labor is now directed by knowledge, and must continue to be so still more in the future, we may be sensible of some surprise at the little effort made in our educational system to meet this want. It will be generally admitted that an educated person should gain assistance from his studies when he comes to earn a livelihood. But our boys and girls, for the most part, have no occupation, and are fit for none when they leave school. They know enough, but can do nothing; they have learning, but no capacity. The industrial pursuits of life, upon which the whole fabric of society reposes, are quite ignored. Education is bestowed upon the mind, while all the executive functions of the physical system are neglected. These executive functions are certainly

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as important as a knowledge of geography, spelling, defining, and grammar, of which the details are so often without interest, and do not in any way develop the faculties that deal with the realities of life; nor do such studies enable the pupils to speak of anything belonging to any calling, pursuit, or manufactured article on earth. It would seem from our system of public instruction that there existed no such pursuits as that by which men can earn a living, no employment which requires manual skill of any kind, and no such things in the world as machines and tools and applied science except as mere figures of speech. To graduate one taught to think only, is like sending a ship to sea in charge of a navigator without a pilot, or a single person on board who can understand or execute his commands. Mental improvement is an inappreciable blessing, but do not the eye and the hand improve the earth and fill the world with comfort and beauty? Man was endowed with both to subdue the earth, and a proper education necessarily includes the cultivation of a taste for lessons in regard to things as well as ideas. Our earliest education is a sensible one, and adapted to our condition. Our first teachers and masters in philosophy are our hands, our eyes, and our sensations. The facts communicated to the child by experience may seem to be acquired rather by the operations of instinct than of intellect, but the term education is as applicable to this training as to the formal teaching of the school. Whatever he sees, or hears, or feels, teaches him a thousand things necessary to a narrow set of exigencies, and gives him the mastery of his limited necessities. He learns to speak after his first or second year, and acquires grammar before he can say his alpha-

bet. He can hear with understanding much that is said, and comprehends the duty of obedience. He knows the effect of heat and cold, and many of the mechanical properties of the atmosphere. Trees and herbs and flowers are distinguished; birds and beasts are recognized, and all sensible objects draw forth questions which display observation and reflection; and, in fact, he acts intelligently upon a great variety of ideal objects. He can appreciate moral precepts, and understands the difference between kindness, honesty and truth, and fraud, deceit and profanity. In fact, many of the intellectual habits of life are formed in childhood; and what he learns of useful truths and their practical application often exercises an influence for good or evil over his subsequent conduct. This is the natural method adopted by Froebel for training children, and consists in learning the reality of things.

Philosophy teaches that mental perceptions depend upon the senses, and that the faculty of understanding objective phenomena is in the mind. Without the senses no object would come into the mind, and without the mind no object would be understood by the senses. The latter can not think, and the former can not perceive. In no other way than by the united operation of both can knowledge arise. We can thus acknowledge the elements contributed by each to our improvement, and that no use of the understanding is possible until it can represent itself in the different objects upon which the hand of labor is employed; for the mere existence of an idea or thought will never give birth to a concrete form corresponding to it, except by the aid of manual skill. This is the condition upon which all improvement or progress depends, and

would seem to suggest the adequate preparation of both sense and mind for the common work. Such, however, has not been the course of education. Thought requires the power of language to express its intelligence, and without words spoken or written, mental operations, it has been held, would have no mode of representation; and it is upon the co-activity of these faculties—thought and language—alone that education has mainly concerned itself. The whole system has, therefore, mostly been the education in language. This partial and one-sided method overlooks the simple fact that words are but the symbols of realities; whereas our vague and indefinite impressions become fixed and palpable only through the employment of manual skill and mechanical art, by which also the imagination, the memory, invention, and emotion, manifest their marvelous and enduring effects. To convey the images of external things to the mental faculties, and to work out the thoughts created in the mind, is the mission of our physical organs. Thus it is that there is carried on between the external and the internal a perpetual correspondence, and the work goes on inside and outside much of the time quite independently of our wishes or our feelings. This mutual relation is upon the principle that whatever adds to the improvement and strength of one will fortify and elevate the other. The eyes and the fingers translate the works of the spirit, and mingle with its thought in the form of useful and beautiful objects. This is the lesson of things which play nearly the whole *rôle* of human experience. Figures, the stars, music, and all sensible objects, are means of sensible information. What would the eye of the astronomer be worth, unless trained to watch the heavens with

an artificial vision to which that of the eagle can not be compared? What would geometry profit if we could handle nothing solid, round, square, or in some other form besides the lines and curves which the eye alone can perceive? What effect would music have upon the soul were it not for the harmonious quality of the ear? Or, how could we learn anything of botany without going among the herbs and visiting the trees? There are no formal lessons in this, little or no didactic teaching. Objects are conveyed to the intelligence which excite reflection and thought, and these again are wrought by the skill of man's physical powers into all the multitudinous utilities of practical life. Does not this community of labor suggest equality of education? A cultivation obtained at the expense of one half of the faculties which are no less important in working out our life, is a vain effort at the perfection of our nature. A culture gained in one respect by the sacrifice of all else can never be anything but a failure, for it is a serious drawback to the educational system, and to the mind itself which receives this preference.

The metaphysicians tell us that the world is governed by ideas. This is a pleasing metaphor for the suggestions of philosophy. Common sense teaches that ideas have little potency until they are incarnated in deeds by the industrious hand of man. The bare idea of steam expansion hobbled along for thousands of years, until the engine of Watt converted it into the greatest power that ever swayed the world. So of the steamboat, the locomotive, the cotton-gin, the power-loom, and hundreds of other inventions that have revolutionized society, and in which practical mechanics have won a herculean victory

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almost single-handed and alone. The essence of power exists in the mind, but without any showing or influence when it lacks executive capacity, which dwells in the organs of the physical frame, and above all in the arm, the hand, and the technic skill of the fingers.

Man is a living force, a fountain of ideas. The organs of the physical frame correspond to those of his mind, and are parts of the same equipment. He has two arms and hands and eyes, and the conception of power without them is weakness. Thoughts are demonstrated by deeds, and the hands and arms are the instruments which redeem this weakness and give us the idea embodied in experience.

The hand is a remarkable example of sinewy power and muscular delicacy of touch, and when its skill coordinates with the eye and the will, many of its acts impress us with profound admiration. It produces results so fine and delicate, that it seems as if the spirit itself passed into the variously-formed objects of its exquisite perfections.

The hand intellectualizes the body. In a certain sense the mind itself is dependent upon it. All fineness of work comes from its sublime possibilities for high labor. Everything that proceeds out of the infinite delicacy of our nature requires its service.

We are indebted to the eye for the perception of external objects in regard to form and color. The hand also aids the eye to attain the same end, and while the eye is situated to insure the widest range of sight, the hand is docile to the command of the mind, and combines and transforms its ideas and sentiments into visible objects. In instrumental music it exercises

"The matchless skill, the potent art that brings
Voices of earth or heaven from those mute strings."

Says a recent writer: "So much does the power and dominion of man over inferior animals, crude materials, and natural forces depend upon the hand that, were it possible to deprive the human race of this important member and put in its stead a mere paw or hoof, it might well be asserted that man would soon find a common level with the beasts, notwithstanding his superior intellect."

This extract illustrates in a striking manner the condition we should be in without the use of this member of our body. Man would be worse off than a savage and more imbecile than the beasts. With its aid the mind subdues the ferocities of nature to the wants of the spirit. It is the symbol of man's power, for while the head wears the crown the hand holds the scepter. The ancients endowed it with intelligent qualities, and foretold the future by its inspection—the gift of prophecy. It grasps all instruments for our progress, from the pen to the plowshare. Its wonderful precision, quickness, dexterity, and discrimination come from an anatomical organization of muscles, levers and pulleys which enables it to perform its numberless operations in the service of man. The finest machinery and inventions fall short of its cunning; and without its ingenious manipulations the comforts of civilized life would disappear out of the industries of mankind. It has even a language of its own. Says Montaigne: "Would you think it? With our very hands we require, promise, call, dismiss, threaten, supplicate, deny, interrogate, admire, number, confer, repent, fear, confound, doubt, instruct, command, incite, encourage, swear, testify, accuse, condemn, absolve, affront, despise, defy, provoke, flatter,

applaud, bless, humble, mock, reconcile, recommend, exalt, entertain, rejoice, complain, refuse, despair, wonder, exclaim, keep silence, and what not; and all this with a variation and multiplication even to the emulation of speech."

Mr. Outis, in his book on "The Void in Modern Education," declares that the great want is an integral education of our various faculties; the culture of the whole human creature instead of a fraction of it, to take the place of the present system, which develops the intellect to the total neglect of the emotional nature: like expanding the boiler, and leaving the furnace unenlarged. The whole scale of graduated animal life exemplifies commensurate development, and the whole scale of social life demands commensurate development. He owns to a cordial interest in art, and confesses that it was while contemplating the perplexed difficulties of English education generally that a discipline in the graphic art—a training of taste, eye, and hand in behoof of beauty and expression—appeared to him with more and more certainty the missing educational element.

While sympathizing in the views of this author as far as they go, a simple extension of the same thought enables us to see that not only do intellect and emotions exist, but that there can be no symmetrical development of the whole man which overlooks the wonderful phenomena of our physical nature. A thousand errors combine to make us wish that the science of human life was better understood and more generally made an indispensable part in the studies of our schools. I know it is often objected that too many things are taught, and that the tendency is to introduce still more. However true this remark may be with regard to astronomy, botany, spell-

ing and defining, or the ancient classics, certainly the study of our own physical organs should stand upon a different footing, since upon a knowledge of their operation and capacity depend our health, strength, and the refinement of our intellectual and emotional faculties. As it is a branch of the same problem, I may be indulged, at the risk of a brief digression, with a suggestion in regard to the training of all the powers and functions of our physical organization. They constitute the forces of living beings and furnish the means of self-preservation. A man may not be able to tell whether Jupiter has four or six satellites, but his ignorance does not disturb their harmony; he may be unacquainted with the marvelous processes of vegetable life, but that does not prevent the plants from maturing into the full perfection of their beauty; he may never have learned the difference between an acid and an alkali, but chemical affinities will display their wonders in spite of all that. It is not so, however, with the structure of our bodies and the laws of physical life. There is a vast portion of human knowledge belonging to special pursuits, and whoever engages in any of these requires a training in the special science or art relating thereto. But a knowledge of the laws of physical development is equally essential to all men. Our external faculties are few, being computed at five, yet in their endowment and operation they are so intermingled and combined as to impart to our outward movements and actions an almost infinite variety of use and expression. When properly trained and in their natural play, they work together like the parts of a well-regulated machine, and the sensory nature moves on to a still larger correspondence with whatever enlarges the mind and brightens the life of man.

CHAPTER II.

Industrial history in France—Her skilled labor and prosperity—Art-schools and the excellence of her fabrics—British trade—Its effect on Europe—Schools on the Continent—The École municipal d'Apprentis in Paris—School at Besançon—School of the Christian Brothers—The École professionnelle of MM. Chaix et Cie.—School at Creuzot—Count Haslach—Weaving-school at Mulhouse and Epinal—Industrial education at Limoges—The École des Arts et Métiers—Government aid to art education in France—State aid discussed—Belgium, Germany, Bavaria, Würtemberg, Nuremberg—The French commission—Schools in other countries of Europe.

THAT education has to do with manual training, is a fact that has been recognized in the educational systems of nearly all civilized nations; and the effect of it upon the useful arts and upon the greatness and happiness of a people has not been better illustrated in modern times than in the industrial history of France. Not many centuries have elapsed since only the great and rich were able to have domestics who were qualified to supply them with some articles of trade in common use. Occasionally an artificer working alone, without influence and without wealth, would furnish an article of beauty, or decorate a church or an altar-piece with consummate grace. But the industrial classes were for the most part in a debased condition. We know that this is changed, and that the most

thorough artisans in the world are found in France, and that the whole earth now pays tribute to her art and taste. She has been devastated by mighty wars; her people have been sacrificed by millions; her expenditure has been almost beyond computation, and yet to-day she is, next to Great Britain, the richest of all nations, while perhaps her people are the happiest in Europe. We can remember her spoliation in the Franco-Prussian War, and the heavy indemnity with which she was compelled to ransom her peace; and we can also remember how she arose as if by some supernatural influence from a prostration which would have indefinitely destroyed the industries of almost any other nation, and attained at a single step to the summit of prosperity. Just exactly how this was managed puzzled those who did not consider her cultivated arts. She had a monopoly in the markets of the world for many kinds of commodities which depend upon design and finish, and in which she had scarcely a competitor. Her skilled labor brought in its account against the world, and every civilized nation contributed to her prosperity. The foundations of her success were laid when art-schools were first established for the instruction of her children. Drawing and designing were taught to thousands of pupils, and their eyes and tastes were at the same time instructed by the beautiful statues and pictures of the masters. These schools have been multiplied until they exist in all the cities and manufacturing communities in France; and the French workman has become the most accomplished artisan that the world has ever seen. An annual importation into this country alone of three or four hundred millions worth of the productions of French industrial art is evidence that it is not the pauper labor

of Europe, but skilled labor of the highest order, that affects our own industries.

The establishment of these schools by the French accounts largely for their superiority in architecture, engraving, and pottery, as well as for the beauty and elegance of their silks, satins, muslins, and brocades; and perhaps it is not too much to say that in all the arts applied to industry the superior excellence of their fabrics is confessed by other manufacturing nations. It is not, therefore, surprising that France has given such a splendid example of industrial or art education.

This was undoubtedly to a considerable extent the work of necessity. Great Britain had spread her dominion until with the *reveille* of her drums, which followed the sun around the globe, her commerce and manufactures were carried even beyond her conquests or colonial possessions. Nowhere had there ever been presented such a combination of facilities for industrial art. She possessed accumulated capital, and her crowded population furnished practiced and cheap labor. These with her abundance of coal, iron, ships, steam-engines, ingenious mechanics, enterprising merchants, hardy sailors, and splendid navigators to carry her products to the ends of the earth, had afforded grounds for the boast of her historian that she was the workshop of the world. The Continental nations viewed this prodigious increase of British manufacture and trade with an eager solicitude; and France, Germany, Switzerland, and others were roused to a determination not to be satisfied without attaining a superiority in all the departments of useful art. Hence came schools of various names but with the same general purpose, adapted to local necessities and the industrial education

of the people. First established on anything like a general footing in France, and afterward in Belgium, Germany, and Switzerland, they have been the means of contributing to the splendid industries pursued in the principal cities and towns of Europe.

Here the workmen are trained intellectually in their special art, and the manufactory, the workshop, and the school-room are not unfrequently combined in the same system of education and reciprocal dependence.

In the present condition of the useful arts it is necessary that workmen should understand the theory of their handicraft. The ideas which have prevailed in Europe have been developed for a number of years in an almost endless variety of schools; and although those schools embrace a very great diversity of organization, and are directed to educating workmen in every species of industry above the rudest labor, yet they all agree in imparting a mixed system of literary and technical instruction. For example, take one of those recently established in Paris, the *École municipale d'Apprentis*. It was founded at the expense of the city, and began its work in 1872. No pupil is admitted before the age of thirteen. The course of instruction lasts three years, about half the time being given to schooling and the other half to practical work in one or other of the workshops. Professor Thompson, after having visited this school seven times, writes that "the results attained by this school are truly striking." When we come, in a subsequent part of this work, to discuss the feasibility of combining industrial with public-school instruction, we will transcribe a more particular description of it, from a recent publication, as probably the finest example of an

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ideal industrial school. It is a striking evidence of the force and direction which industrial education has attained in France, and of how much is being done in that country to invest mechanical labor with honorable distinction, by giving to the humblest children the means of practical education, so that by their intelligence and skill they can earn a livelihood and aspire to a condition far superior to their present one.

The famous municipal school of theoretical and practical watch-manufacture at Besançon is an instance of a technical school founded at the expense of the city which is the principal seat of the industry it is designed to promote. Besançon supplies four fifths of all the watches sold in France, and the school has for its object thoroughly to teach the children in the trade they intend to follow. They are taught not only to turn and temper metals and to make the several parts of a watch, but to manipulate atoms as small as the grain of sand that drops through the hour-glass; and their technical education relates to everything having a bearing upon the work, such as arithmetic, mensuration, geography, mechanical drawing, geometry, and composition. When they have completed the course of study, they know how to mark the divisions of time with ease and accuracy for horological purposes, and can graduate the dial of a common watch so that a second-hand in its circuit can be read at each fiftieth of the circle it describes, and the vibrations of a pendulum beating seconds through every hundredth division of its proper arc. Skilled labor in this ingenious art constitutes the wealth of that community; and the public, appreciating the general effect, are willing to incur the burden of its support for the general industrial and commercial ad-

vantages conferred by a thorough and educated knowledge of watch-making.

The schools of the Christian Brothers, located in the Rue de Vaugirard, Paris, may be considered a good example of a private institution for ordinary instruction and manual training combined. It has frequently been mentioned by writers with much commendation. The school-buildings form a quadrangle, and the inclosure serves as a play-ground. The students are as young as eight or nine years, but are not put to a trade until they attain thirteen. In the mean while they are instructed in the elementary branches, and, in addition thereto, in architectural and mechanical drawing in outline and shaded, with free-hand drawing and the rudiments of designing as applied to industrial objects. Those destined for an industrial career are, at the age of thirteen, put to learn trades in the workshops connected with the establishment. "Gilding, carving in wood or stone, trunk and portmanteau making, shoe-making, tailoring, weaving, book-binding, astronomical, mathematical, and musical instrument making, are among the trades taught there to one hundred and thirty boys, who spend two hours in the workshop and the remainder at their books." The boys pay about one franc a day for board, lodging, and instruction, and those who are unable to pay the whole amount are assisted out of a fund created for that purpose from the donations of the charitable and the well-wishers of the institution.

The course comprises three years, and the schooling is not only as good as in other schools, but at the end they are well qualified for some useful occupation. The pupils work from drawings, which are mostly prepared by them-

selves; for all learn drawing and modeling, and all industrial instruction is given by practical workmen in charge of the shops. Lessons and manual occupations alternate morning and afternoon. During the third year each pupil settles down to the particular pursuit he most fancies or which is best adapted to his talents. In speaking of the result the director observes: "Our apprentices, being at once fit for useful work on entering the employment, are less often employed to run errands, they are better treated, and steadier. I could tell you of young lads of fifteen who are actually earning two francs and a half and two francs and seventy-five centimes a day, and who in six months more will be paid as regular workmen."

One of the British artisans described his visit to this school as a "grand treat."

Another peculiar development is the interest manifested by large business companies in the subject of industrial education. Some of the finest schools are attached to these establishments. Such is the *École Professionnelle* in the printing-house of *Messieurs Chaix et Compagnie*, in Paris. Two hours a day are allotted to lessons in the school-room, which is contiguous to the workshop. The teaching comprises a special primary course for those whose schooling has been insufficient; a technical course, including grammar and composition, reading of proofs, the study of types, engraving, and the reading and composing of English, German, Latin, and Greek, as far as to qualify for type-setting, and a variety of other studies chiefly having a bearing upon the business of printing. The course lasts four years, and the apprentices receive wages according to the work performed. At the end of the apprenticeship the pupils elect, almost without excep-

tion, to become employés of the firm, and enter at once into the rank of participants in the yearly division of the profits. Says the writer from whom these facts are taken: "The financial results of these arrangements, at once educational and prudential in their nature, are most encouraging. M. Berger, the accomplished inspector of this department of the enterprise, attributes the substantial growth and prosperity of the business, now one of the largest and wealthiest in France, as much to that influence as to any other. He prides himself upon the superior intelligence of his pupils and their technical knowledge, gained while they are in the very midst of a great business, and thus forced to keep *au courant* with commercial exigencies. The few who have gone out to take places elsewhere are also doing well."

Aside from the technical and professional training afforded by the schools, there are certain marked features in the establishment which give it the air of a brotherhood. The employés and apprentices are organized into several institutions, forming a system of mutual benefit to promote the interest and welfare of all. Some of these funds are contributed by members themselves, others by assessments upon the profits of the business, and still others by the voluntary gifts made each year by M. Chaix for the benefit of the apprentices. There are also savings-funds and accidental and life insurance funds for the benefit of the workmen. Messieurs Chaix et Compagnie cherish feelings of active personal interest in their employés, and cultivate a fraternal relation with them in all their intercourse and dealings. And the great success which has marked their business career points in more ways than one to the legitimate connection between capi-

tal and labor, and shows what may be accomplished by kindly offices and mutual benefactions.

There is another eminent example of a school founded by a business company for the technical instruction of their workmen, at Creuzot, where the most important iron-works in France are located. Previous to the year 1836 it was a miserable, poverty-stricken village of about 2,700 inhabitants, and so hopeless was the business that for several years it had been almost abandoned. At that time the place became the property of Messieurs Schneider, to whom the works still belong, with some other partners of limited liability. In 1867 the place was visited by Mr. Bernhard Samuelson, of England, then a member of Parliament, and his description of it has been transcribed by Mr. Stetson in his book on technical education. It exhibits the very wonderful results which have been achieved by organization and the schools established by the company for the instruction of their workmen. The course consists of a number of elementary studies, with others, such as natural philosophy, the chemistry of metals, mechanical and free-hand drawing, and modeling. The most promising boys are sent to the higher technical schools, and they return to fill the responsible positions in the management of the extensive business. The other boys are drafted from the school into the works, and are placed there strictly according to the capacity which they have shown at school, some as simple workmen, others as accountants and draughtsmen. Of late years the pupils from the *École des Arts et Métiers* have been appointed to teach special classes in matters bearing directly upon the occupation of the workmen, and including, as one of the most important, a com-

plete course of machine-drawing; and there is not a man among the mechanics employed in the construction of engines who could not make an accurate drawing of the work on which he is engaged. Under these influences the little village has become a well-built and well-paved town, with its churches, its schools, its markets, its gas and water works, and twenty-four thousand well-fed, well-educated, and decently-clad people. And in this connection I can not omit mentioning, although they are not in France, the celebrated workshops of Count Hasrach, upon his estates at Neuwelt, in Austro-Hungary, for the manufacture of artistic glassware. Every workman in his factories has received a special training for his occupation, and has even enjoyed a preliminary course of travel over the Continent, to visit other works of the same kind, so as to expand and instruct his mind before commencing the practical business of life. These causes have resulted in the highest state of perfection to which the processes of enameling, painting, embossing, and engraving on glass have been brought. The works were properly represented at the International Exhibition in the city of Melbourne, where it is reported that the exhibit included the rich ruby and the delicate amber glass, the malachite, the frosted, and the granulated gold or rainbow glass, as also that which is crackled by plunging the vessel, when it has reached a certain temperature, into ice-cold water and then replacing it in the furnace; the alternate expansion and contraction to which it is thus exposed giving it the appearance from which it derives its name. Drinking-cups of green enameled glass, of mediæval designs; vases decorated with pictures of exquisite finish, worthy of the pencil of Watteau; others

covered with a white enamel, and others still ornamented in sunk silver, were all conspicuous for their beauty and splendid finish. Here is another example of an individual actuated by the laudable ambition of providing remunerative and skilled employment for the people on his estates, and to perfect and improve a beautiful branch of art industry, and who has devoted himself to both objects with the grandest results.

The Power-Loom Weaving School, at Mulhouse, differs from any of those already mentioned in this, that it was founded by those engaged in a particular branch of industry, by the manufacturers as a class of that place, in order to provide intelligent workmen, and to promote the peculiar industry of Mulhouse, and to enable those engaged in it to produce better textile fabrics than could possibly be done by ignorant workmen. The beneficial results were acknowledged far beyond the limits of that town, for they have been of immense value to that industry throughout the whole province of Alsace. The school was suspended by the Franco-German War. The Industrial School at Epinal was founded in 1871, to supply the place of the one at Mulhouse, with a similar system of instruction, except that perhaps it is of a still higher grade. The students' work will compare favorably with that performed in the great schools of arts and trades. Mulhouse is famous for its fine muslins and cotton prints, of which a greater quantity is made here than in any other place. Its manufacturers excel in the processes of dyeing cloth. The best means of extracting the organic colors for the practical use of the printer have been discovered by the accurate investigation of each distinct coloring-matter separately. This indispensable knowl-

edge has been furnished by the practical chemists who are constantly employed by the manufacturers; and the most effective manner of applying them to textile fabrics in the form of attractive patterns is by the rules inculcated in the school of design which still belongs to the "Society of Industry."

The Government of France recognizes the vast importance of extending its assistance to schools for the technical instruction of her youth. A conspicuous evidence of this has recently been given by a decree relating to the technical school at Limoges, by which it became a state institution. In ancient times Limoges was renowned for its works in enamel, of which many choice examples are still found in the ceramic collections of Europe; and it is a recommendation of a modern design to say that it is after the style of the old Limoges enamel. The town suffered greatly from the decay of this industry, for it almost completely run out. In 1766 kaolin was discovered near Limoges in great abundance and of excellent quality. Porcelain-works were established, and the place is now the center of that industry in France. In 1862 the school, which has just been adopted by the Government, was founded by Adrien Dubouche. Convinced of the vital importance for a special training of the young who were to work at the trades of the place, he established the school out of his own means and by the aid of the municipality, from whom he obtained a small subvention. He also established free town schools to teach the fine arts, as applied to the industrial arts, and gave them his personal attention and supervision. Owing to these causes, Limoges has again become a great seat of art-industry. Immense establishments in porce-

lain manufacture have grown up, and poverty and drunkenness have disappeared. This town was the birthplace of many great men, of whom the chief are Pope Clement VI, the Chancellor d'Agnesseau, Vergniaud, Marshal Jourdan, and others; but none of them all deserves a monument to his memory more than the industrial philanthropist Adrien Dubouche.

By the governmental decree, it is reorganized under the title of *École Nationale d'Art Décoratif à Limoges*, for the purpose of training boys and girls—for it is open to both alike—as teachers of drawing, and for the exercise of trades connected with art. It provides instruction specially appropriate to the trades chosen by the pupils. Besides several general studies, there are also special courses for different applications of drawing for trade purposes, pottery, enameling, and engraving. Provision is made for prizes, scholarships, and examinations. The boys, on entering, must be over thirteen years of age, and the girls over twelve. Tuition is free.

Among the examples which the French Government has given of its interest in the technical education of the people, the *École des Arts et Métiers* is perhaps the most remarkable. I transcribe a small portion of the report made concerning these celebrated schools by Joshua L. Chamberlain, one of the commission from the United States to the Paris Exposition of 1878, upon the subject of education. I select the following only:

It was the Convention in 1784 which decreed that there should be formed in Paris, under the name of the Conservatory of Arts and Trades, a public depot of machines, models, tools, drawings, descriptions, and books upon all arts and trades, the construction and employment

of which should be explained by three demonstrators and a draughtsman attached to the establishment. The end proposed by the founders was the practical instruction of workmen. Their motto was, "They must be made to see rather than to speak." Four years later an ancient priory was opened for this great work. Such was the beginning of an institution which has engaged the interest of some of the greatest men of France, and which has rendered so great service to industry in illustrating and explaining the applications of science to the arts. It has to-day a costly library of 24,000 volumes relating to science, art, and industry, installed in the ancient refectory, now splendidly restored, and which disputes with Sainte-Chapelle the distinction of being the most elegant and graceful monument of Gothic architecture which exists in France. The Conservatoire has a collection of objects appropriate to its design, the mere titles of which fill a volume of four hundred closely-printed pages. At present there are fourteen chairs of instruction. It may be well to give their designations, and the names of the professors occupying them :

Geometry applied to the Arts.—Colonel Laussedat.

Descriptive Geometry.—De la Gournerie.

Mechanics applied to the Arts.—Tresca.

Civil Construction.—Trelat.

Physics applied to the Arts.—Becquerel.

General Chemistry in its Relation to Industry.—Peligot.

Industrial Chemistry.—Gerard.

Chemistry applied to the Industries of Dyeing, Ceramics, and Glass-working.—De Luynes.

Agricultural and Analytical Chemistry.—Bousingault and Schloëssing.

Architecture.—Moll.

Agricultural Works and Rural Engineering.—Mangon.

Spinning and Weaving.—Alcan.

Political Economy and Statistics.—Burat.

The course of instruction is not unlike that at the Sorbonne, the College of France, and the Museum of Natural History. The lectures are public and free to all, foreigners and citizens alike. It is a deeply interesting scene for an American to sit amid that motley auditory, sometimes numbering nearly a thousand, all listening intently to the masterly yet simple expositions of men like Becquerel, Burat, Gerard, and Levasseur, of all conditions and ages, from the boy of twelve, first waking to the thought of the possibilities in the great world before him, to the dim-eyed sire of eighty years, now at last realizing what might have been. There are as many as 160,000 of these auditors each year.

The schools of arts and trades are designed to train superintendents and foremen of workshops and well-instructed and skillful artisans in the working of iron and wood. There are three of these in France—at Châlon-sur-Marne, at Angers, and at Aix. There are at each of these three hundred pupils, admitted upon competitive examinations. They are between the ages of fifteen and seventeen years. These pupils live in the school-building.

The course of study extends through three years. The theoretical teaching comprises arithmetic, geometry, elementary algebra, rectilinear trigonometry, descriptive geometry, mechanics, physics and chemistry, drawing, geography, grammar, and accounts. Seven hours of labor a day are devoted to practical instruction given in four workshops—carpentry and modeling, foundry, forging, and adjusting. Diplomas and silver medals certify to the aptitudes of the pupils, and serve as recompense at the end of the course.

The exhibits of these three schools attracted considerable interest. Steam-engines of various sorts, machines for use in wood and iron work, showed the theoretical and practical mastery attained by the pupils. The drawings and other exercises were also highly creditable.

From this brief sketch we may learn the immense weight which the French Government and people attach to the subject of industrial education, and the thorough and splendid manner in which they treat it.

It is noticeable that Government aid to art education is never contested in France, and it has always played a considerable part in the technical instruction of the working-people. The question is regarded as one of public interest, and the current administration might as well abdicate its power as to ignore its responsibility for the support of art-schools. Governments have succeeded each other pretty often in France, but these ideas and purposes have survived their successive falls; and each in its turn has recognized the improvement of the people in the useful arts as among the highest obligations of executive authority. The need and security of public assistance is so well fixed in the customs of the people, and is so completely identified with the tendencies and expectations of the country, that every Minister of Public Instruction, from M. Cousin to M. Jules Ferry, has used the most liberal exercise of his office in its behalf. Like the elementary schools, they are placed under his authority. The instruction is free to all, the law is equal to all, and there is an opportunity for any boy in France, however poor his circumstances, to obtain an art-education which shall cost him nothing. The Minister of Public Instruction is of high official importance; he is a member of the Cabinet; his estimates are placed in the budget, and, notwithstanding the magnitude of the other departments of the Government, he is recognized as representing the most important interests in the republic.

“In every town of any importance in a manufacturing

point of view, in every district of all the principal cities, there is to be found the art-school, just as there is to be found the church or the baker's shop." The examples already given are only typical ones, of which there are hundreds besides. All the elements of society conceive themselves equally interested in this preparation of the rising generations. Need we be astonished at the perfection of art-industry in France? The explanation is easy when we consider the causes of these wonderful phenomena.

With us, the idea that the state should share with society in the public instruction of the useful arts looks like an interference with private right. Perhaps the limit of legislative action is not easily determined. But surely, when the object is not in the interest of a favored class, but to raise up and elevate all the industrious classes together for the benefit of the whole body, it ought not to be regarded by any sincere friend of the race as an infringement upon the guarantees of equal laws. Whether this is so, will be discussed when in the course of this work the subject of manual training in the public schools shall be reached. Meanwhile, we may learn much from France, for the people there would hold the Government extremely culpable that would neglect a duty so sacred.

In Germany something of the same kind had been attempted, perhaps at an earlier date than in any other quarter of Europe; and it is highly probable that the schools there for training workmen are among the most remarkable in Europe. Schools of design, and polytechnic and industrial schools, are as numerous as any other kind of schools. But the best German exhibits of art-

schools in the Paris and Vienna Expositions of 1867 and 1873 were those from Bavaria and Würtemberg.

It is most unaccountable that there were no educational exhibits from Germany at the Expositions of 1876 and 1878. This is the more to be regretted, since it is supposed that she leads the world in matters of education.

The schools at Nuremberg are characterized by distinct and peculiar merits which deserve to be noticed, information of which comes from another source, that of the sub-committee of the French Commission appointed to inquire into the state of technical instruction in Germany and Switzerland, who say in their general report: "In this town (Nuremberg), so noted for its various manufactures, there are several drawing-schools of different degrees, according to the trade the pupils intend to follow. The first and most important is the higher school of industrial drawing, conducted by M. Kröling. It is justly regarded in Germany as the one which has rendered most service to industry"; and after stating the method of teaching, the report adds, "The general opinion of the persons who have made a study of questions connected with teaching, not only in Bavaria, but also in other parts of Germany, is, that the Nuremberg school has contributed more than any other to the progress of the national industry."

I transcribe a single sentence from the special report on Würtemberg: "There have been established, in the kingdom of Würtemberg, more than four hundred drawing-schools; and this organization, which does not date back more than ten years, has already led to very decided improvements in the manufactures of the country. It is satisfactory to know that the designers trained in these

schools, if they evince any considerable degree of taste and invention, easily find occupation in their own country. The more distinguished of them are sometimes sent to France for improvement. . . . They " (the schools) "were founded after the Universal Exhibition of 1851, to enable the manufacturers of the country to compete with France in the industrial arts."

Industrial schools in Austria and Hungary have kept pace with those of other countries. They are very numerous in Switzerland, and have been introduced in Italy, Sweden, Denmark, the Netherlands, and even Spain, as a systematic part of public instruction.

We conclude this chapter by saying that we shall return to the subject of industrial education in Europe in one or two of the chapters following.

CHAPTER III.

Industrial Education in Russia—The Practical Technological Institute at St. Petersburg—The Imperial Technical School at Moscow—Exhibits of, at the Exposition of 1876 and 1878—Moscow fitly chosen—Two other schools for teaching trades to boys—Movement in England—Continental artisans—British artisans at Paris Exposition, 1867—Schools of art-instruction—South Kensington Museum—Walter Smith—French and English methods compared—Spread of art-schools in the United Kingdom—Their effect upon industries requiring art—Comparison of art-products—The leading nation in the industries depending upon art—Advantages stated—The favorable effect upon the artisan—Favorable to morality—The problem abroad.

I do not pretend to any special knowledge upon the subject of industrial education in Russia, aside from what may be learned by any one who will take the trouble to read the general report of Governor John W. Hoyt, one of the commissioners of the United States to the Centennial Exhibition of 1876 (Vol. VIII, page 165). The Russian educational exhibit is referred to in that report with a fullness of description quite justified by the very interesting character of the movement in that empire for technical and practical education combined. The Russian publications and circulars elucidative of the system are set forth, and certainly constitute a chapter in the history of practical instruction which must have a marked effect, not only upon Russia, but in every other country where

professional and technical schools exist. Indeed, the commissioner closes one part of his report with the remark that "what Russia has done for technical education at the Philadelphia Exhibition no man may now estimate. It is certain that the service was very great, and has earned for her the gratitude of all who are at work upon its problems, whether in the Old or New World."

Much useful information is furnished in the report in regard to the Strongonoff Central School of Practical Drawing, and the Pedagogic Museum at St. Petersburg, both of which are important auxiliaries in the development of industrial studies. The institutions, however, that come nearest to the subject of this work are the Practical Technological Institute at St. Petersburg and the Imperial Technical School at Moscow. It is only after having observed and studied their exhibit with great and scrupulous care that the commissioner analyzes and comments upon them as perhaps the most admirable agencies yet employed upon the problem of industrial education. Owing to the backward condition of Russia, it is difficult to obtain reliable statistics, and it is most fortunate that such a competent and disinterested observer as Governor Hoyt had an opportunity to see and hear for himself to the minutest and most complete detail. But our space limits us to a statement of some of the principal facts only, and the impressions which they suggest. The two technical schools are founded nearly upon the same principles. Before entering the institute at St. Petersburg, the candidate must have graduated from one of the middle schools, and must pass a competitive examination. There are two depart-

ments, mechanical and chemical. In the mechanical department the course includes a variety of studies having relation to applied mechanics, the art of construction, and mechanical drawing, and a part of the time is employed by the students at manual labor in various workshops and mills belonging to the institute.

The system is as follows : "The practical studies are divided into three courses. In the first course the student works with a chisel and file upon cast iron, performing six consecutive studies ; in the second course the students begin upon wrought iron, fulfilling nineteen consecutive tasks ; thereafter they are removed to the fitting-shops, where they are obliged to perform fifteen tasks, occupying themselves with turning, cutting screw-threads, and soldering. The last course is in the construction and joining of different engines." During the five years of the course of study, six hundred and forty-eight hours are devoted to manual labor in the workshops. Of these there are four : "The filer's shop with sixty places, each fitted with a vise and the necessary tools for the filer's course ; the forging-shop, with ten places ; the turning-shop, with sixteen places ; and the construction-shop. In the first three the students work in alternating sections until they have completed the obligatory courses."

In these shops the students, under the management of experienced masters, begin to exercise in the most simple works, gradually passing to more complicated, and at last finishing with constructions and joinery of all the parts of an engine. Finally, they graduate either as engineers for workshops or for railroads, and their practical teaching has made them skilled workmen in the use of a great variety of tools.

In some of its leading features the Imperial Technical School at Moscow is not unlike the Free Institute in this country at Worcester, and the Manual Training School of the Washington University at St. Louis. It has, for instance, a special division divided into three branches: mechanical construction, mechanical engineering, and technological engineering; and, in connection with these, all the sciences are taught which are considered fundamental or collateral to any given branch in the course, and the students of all the classes are occupied during a stated period of time in practical work in the laboratories and mechanical workshops. These shops are under the management of a technologist or skilled workman, whose duty it is to instruct the pupils in the rudiments of mechanical labor, so that in the first place they become acquainted with all the work of mechanical art, namely, turning, fitting, carpentering, and forging, in the school workshops, and they are then deemed qualified to be admitted to what are called the mechanical works. These latter are distinct from the school workshops, for they are placed upon a commercial footing with hired workmen, accepting and carrying out orders from private individuals for the construction of steam-engines, working-engines, pumps, motors, agricultural machines, etc. It will be seen, therefore, that while the school workshops are designed to impart manual knowledge and dexterity, the mechanical works are for the education of young men in the branches of mechanical engineering and mechanical construction of the highest order. The object of separating the school workshop from the mechanical works was to secure the systematic teaching of elementary practical work, and to admit the pupils only to the latter when

they have perfectly acquired the principles and habits of practical labor. In the workshops the pupils learnt the use of tools which the common and otherwise uneducated class of work-people may be expected to possess, but a practical knowledge of which is quite indispensable at this moment to the educated technologist. Acting, therefore, upon the principle that mechanical engineers and constructors should have a practical experience in the mechanical arts, the Imperial Technical School has employed the separation of work and the graduation of studies in such manner as will best secure a solution of the difficulty in the best possible manner and in the shortest space of time. The director, from whose circular these facts are gathered, concludes his elaborate statement by observing that "eight years have already elapsed (1876) since the programmes of instruction in the mechanic arts were introduced into the workshops of the school, and they have been found to attain in the most brilliant manner the aim proposed in their introduction."

In order to show the methods employed in the school at Moscow, as well as the completeness of its exhibit at the Centennial, the commissioner has added a synoptical statement of its samples and tools, which alone occupy nearly six closely-printed pages of the report.

In the year 1870, at the exhibition of manufactures at St. Petersburg, this school first exhibited its methods of teaching mechanical arts; and from that time they have been introduced into all the technical schools of Russia, which are on the increase and now exist in nearly all the principal centers and cities of the empire, affording educational facilities in matters of useful art on quite an extensive scale.

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In a country like Russia, which is so far behind every other European nation in education and civilization, and where it is estimated that not over eight per cent. of the men and three per cent. of the women have ever had any schooling, these institutions at the two capitals must exert a most beneficial and wide-spread influence. They and kindred schools are sending forth every year hundreds of men educated, enlightened, and skilled in the civilizing arts of life, and will carry with them the elements of civilization in their highest perfection wherever they go in that vast empire.

There is a peculiar fitness in the establishment of this noble institution in the ancient capital of Russia. Moscow still attracts our sympathies. By historical necessity it was the capital, and by religious tradition the holy city of the empire. For centuries it was the theatre of all the calamities resulting from wars, sieges, fire, and pestilence. The Muscovite princes founded Russia from the mass of barbarous tribes, and created the splendid reign of the Czars. It published the first code of Russian laws, and introduced the first attempts at civilization among the uncultivated multitude of its wandering tribes. And, more lately, in order to preserve the security and independence of the country from the footstep of the invader, who was already reposing within the sacred walls of the Kremlin, it delivered its towers, its palaces, its cathedrals, and its dwellings to the flames of a conflagration which destroyed them all; and thus associated the terrible event in the heart of Europe as the most devoted and costly tribute that had ever been placed on the shrine of patriotism. But by the foundation of the Imperial Technical School she promises a greater service than she has ever

rendered for the cultivation and refinement of the people.

Again, at the Exposition of 1878, the Russian exhibit of industrial school work was admitted to excel all others. Four of such schools were represented, two of them being of a grade inferior to those already described, viz: the Alexander Technical School, situated at Tcherepovetz; and the School of Trades of the Czarowitz Nicholas, at St. Petersburg. In both the pupils receive a general education, and the boys are admitted at the age of thirteen and fourteen. Simultaneously with their general studies they are taught the use of tools in several trades, and, after having acquired the requisite proficiency in handling them, they make choice of a trade, to which their workshop practice is afterward confined.

England did not regard with indifference the effect produced upon the manufacturing arts by these new educational forces. She plainly foresaw her inability to maintain her superiority in the markets of the world, unless she also took steps properly to instruct those who were to carry on the great industries upon which her welfare depended. The education of her workmen attracted the attention of her thoughtful and influential classes, and technical schools were established soon after the Exposition of 1851. It was there made evident that her manufactured articles, although in strength and solid workmanship quite equal to any others on exhibition, were yet much inferior in appearance and ornamental design when contrasted with the finished products of French and German art. The Continental artisan is trained in the principle of his trade. He is generally able to prepare his own drawings and make his own models; or, if not suf-

ciently skilled or ingenious to invent a beautiful design, or to give a new shape or configuration to a manufactured article, he can at least decipher it with a relish of its appearance. He therefore works with pleasure, and views the product of his labor as the offspring of his skill, and perhaps of his genius. His industry is inspired by his enthusiasm. From the mold of a button to the perfection of a bronze, all is a work of art.

The English Council of Arts and Science sent eighty skilled workmen, representing almost every industry, to the Paris Exposition of 1867, and to visit various workshops and manufactories in France. Each workman, upon his return, was required to furnish, and did furnish, a written report, giving the result of his observations. A condensed statement of these reports is given by C. B. Stetson, in his admirable book on "Technical Education," and he justly declares that they "form one of the most valuable contributions to the industrial literature of the day." The impression was not favorable to English art, but it gave a prodigious impulse to industrial education, and schools devoted to art-instruction became very numerous. Those at Nottingham, Birkenhead, Coventry, the Wedgwood Memorial, and the Burslem School of Art, rank perhaps as among the most important. But the first place must be assigned to the South Kensington Museum, London, and the schools attached to it. Here are taught children from under ten years of age in free-hand drawing, up to the highest professional instruction in every branch of art. In the work on "Art Education," by Walter Smith, we find a brief account of this institution, from which it appears that it is the national training-school, from which most of the teachers in the local

schools of art come. It is the opinion of Mr. Smith that there is no fundamental difference between the English and German systems, except that the latter is the most scientific of the two. The same stages of study are common to the national training-school and to those throughout England, and from this circumstance there is a general similiarity in the works of all the schools, and harmony in the national system. This systematizing of art-study is made more certain by the annual examinations of the schools in every grade of study, with the same tests for each grade in every school throughout the country. The building up of this system has taken many years to accomplish. The distinctive features of the scheme date from the year 1851, and the details have been wrought out and consolidated by successful experiment since that time. The administration is in a department of the Government, and thus uniformity of plan is secured.

The author then explains the agencies employed for industrial art education: 1. A museum of industrial masterpieces, and a large portion of the national collection of pictures. 2. A national training-school for art-masters. 3. A traveling museum for exhibition, which circulates good specimens of industrial art in the provinces, and forms the nucleus for local exhibitions; and also the circulation of books and paintings, on loan, to provincial schools. 4. Examination and supervision of all grades of art-instruction carried on in connection with the national system. Art-instruction is divided into three grades, progressing in difficulty, and called first, second, and third grade. The first grade of instruction is given in day-schools to children by teachers holding the

second-grade certificate. Examinations in this grade are conducted in three subjects—free-hand, model, and geometrical drawing. The second grade comprises the elementary instruction in schools of art and night drawing-classes, and is the grade in which teachers of the national or common schools become certificated. The subjects are free-hand, model, geometric, and perspective drawing, all in outline; to which is added, for teachers, black-board drawing from memory. The third grade consists of the highest subjects of instruction in drawing from copies, casts, nature, and original design; painting, modeling, architecture, drawing and design, and mechanical and machine drawing from copies and models, which form the studies in schools of art; and the masters or mistresses of such schools have to become certificated in this grade before the Government recognizes them as art masters or mistresses. The drawings are sent to London for examination, exhibition, and rewards. The studies are twenty-three in number; and the certificates are awarded after an examination at the close of the winter session.

After noticing the effects of this system, Mr. Smith reasons that, as a scheme of art-education, comprehending all the necessities, whether of the child, the artisan, or the art-student, the English must be acknowledged to be more thoroughly adapted to the general wants of all grades of society than any other; because it has more scope, is progressive in its grades of instruction, and provides, what no other national system does so thoroughly, for the professional education and examination of the art-masters who are to carry it out; and he concludes by observing: "I have spoken more fully on the scheme of

art-education originating in England than I should have done otherwise, because its recent success, both in common-school instruction and influence upon manufacturing industry, has drawn the attention of the whole world to its organization and system; and also because I have noticed that theorists, who know little or nothing of either plan (English or French) practically, are in the habit of comparing French and English methods, to the great disadvantage of the latter. Now, I entirely disagree with that view, and hope that I can judge impartially of the two, not blinded by national prejudice, but as a practical educator, having already written, perhaps, more in favor of French art-education than any other Englishman; and I contend that, in this subject, as in all others, before any person is competent to discriminate the good points of both systems he must be familiar with both, in the class-room and lecture-room—not for a day or year, but for many years—and see the effects upon many students through a whole course of study. This has been my experience. When I say also that a better scheme than either can, I believe, be developed in this country, it will be seen that, while I have more faith in the English than the French system, I hope that the American will be the best of all. Still, it must be remembered that we are, in this country, only buckling on our armor, and must not boast as those who are taking it off.”

The progress of these schools, in elevating the taste in art-industry and enhancing the standard of industrial products, has been more marked on the British Isles than in any other state of Europe. The technical or science schools and the schools of art in the United Kingdom exceed in number those of any other country. Some of

them are private institutions, some are endowed and entirely free, and many of them receive assistance from the Government or from the community in their neighborhood. They each have from four to six classes in industrial art, and many of these are night-classes, to accommodate those who cannot attend during the day. The teachers come mostly from the National Training School at South Kensington. The number of schools may be estimated at several thousand, representing every branch of industry, art, and applied science.

The magnificent work accomplished by these institutions has been most beneficial upon the great interests of the British Empire, since to this cause may be ascribed her rapid progress in the art of improvement of domestic manufactures, by which she furnishes not only the cheapest and best goods, but those which are attractive and salable by their style and appearance, thus maintaining her enormous commercial industry without a parallel among foreign nations. Mr. Nichols exhibits the statistics showing the increase of art-productions in Britain over those in France of late years before he published his book. From 1847 to 1856 it appears that thirty-five per cent. of the French exportations were of art-industry, and from 1856 to 1868 they scarcely amounted to sixteen per cent., a decrease in twelve years of more than one-half. Now, during the first period France was nearly ten per cent. ahead of Great Britain, but during the second period, that is, from 1856 to 1868, the export of British products in which art was required exceeded in value those of France 505,000,000 francs, and with a greatly increased value in her total exportations her art-products were twelve per cent. more than those of France. In other

words, while this kind of industry had increased in Great Britain 442,000,000 francs, it had decreased 68,000,000 francs in France. These figures exemplify in a striking manner how great had been the change and how immense the progress of the British Renaissance since the introduction of art-instruction for her industries. The author observes: "Until within a few years, the superiority of France in its art-productions was not doubted or contested. With those articles of industry into which art entered she filled the markets of the world. With a self-confidence peculiar to her people she became careless, and it was not until half her trade had escaped her that France was conscious of her loss." We shall see, however, how quick France was to act when she found her great rival taking the lead of her where she supposed herself perfectly unapproachable. Great Britain beheld her inferiority to France and Germany reflected in the International Exposition of 1851 at the Crystal Palace, and, instead of being dismayed, set about the most systematic and comprehensive plan of art-education the world ever witnessed. Never has there been an educational enterprise so considerable and so vast, and, from an intelligent point of view, never has the effort to instruct an entire nation, under similar conditions, been attended with such grand results. The English were thought to be indifferent to if not incapable of art ideas, and that a long period of preparation would necessarily precede any visible results of the experiment. But the astonishing rapidity with which results have been developed would almost lead us to the belief that, instead of being an inapt race, the intuitions of art are almost spontaneous in their soul, and that they are gifted with a marvelous dexterity in execut-

ing them. It is at least certain that this people, whose ideal sense was so underrated, has suddenly been transformed into the leading nation in the products of industry which depend upon art or beauty. We cannot ignore the precision and grandeur of the means by which the English nation has secured her commerce and her safety.

I have confined my attention to one feature only in these schools, viz, as a means of cultivating the mechanic and useful arts. To this, however, might be added many other splendid advantages. No one will deny the refining influences exerted upon popular taste by drawing the beautiful forms of design, in contemplating the finest models, and the *chef-d'œuvres* of the masters in sculpture, painting, and architecture. General Meigs was particularly delighted with what he observed at the Vienna Exhibition in 1873, in regard to the distinguished excellence of the English drawings on exhibition, and he compliments them in his report by saying: "One of the most gratifying parts of this exhibition was the drawings from the English art-schools; the gradual creeping of art in its highest sense into the common course of education, thus permeating all parts of society, elevating, refining, and ennobling our aspirations."

The same person is often able to execute what he designs, and then he can see the interpretation of his thought in the work of his hands; and I apprehend this must add very much to the enjoyment he experiences in his industry. Man acts upon man, so that a sympathy naturally grows up by which those with whom they work, and those for whom they work, have a common sentiment and object, that of making things beautiful as well as useful; for the useful can no longer exist apart from the beauti-

ful. The artist who designs a magnificent building, or a masterpiece in painting, enjoys the happiness as well as the temperament of genius. It is the same to a degree with the minor arts which minister to our daily comfort; and the workman who fabricates a cup, a vase, a bronze, or any object of utility in which form, color, and design are embodied, experiences an emotion of the same kind, and an intellectual pleasure which he makes apparent on his work. The art in both cases is of the same general nature. Like the leaf and the fruit that grow joined on the same stalk, there is a friendly relation. The idea comes from the unseen world within—the masterpiece of the highest art to please the eye, and the object of utility as an accessory to man's happiness. The art of the artisan and that of the artist may differ in the objects to which they are applied, but they have so much in common that the same fundamental graces and beauties play an important part in their respective studies. Art is no respecter of persons, and she acknowledges her offspring, however humble their origin. She is a powerful enchantress, and is to-day engaged in the personal service and gratification of the art-workman wherever employed. She not only embellishes his work but his life, and refines his industry with an exquisite taste. His sentiments run along with his hands and eyes and strike into his very temper, making his toil less wearisome, and giving him many delightful thoughts and happy moments to relieve the burden and perplexity of his labor.

In a work consecrated to the problem of industrial education, I have commenced with a presentation of actual facts, and have, therefore, given this brief account of what exists abroad. A successful example is of more

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practical value than the most confident affirmations. What is industrial education? What are its merits and objects, and, above all, what power does it possess of administering to some useful purpose in the productive arts of life? Now, if we can speak from things we have seen, and where the whole problem in question has been worked out in all its details, we can answer these questions with exactness and precision, because we know what we are talking about. Hence the necessity of consulting successful examples abroad, when they have such a direct bearing upon the current facts in our history.

CHAPTER IV.

The United States—Dependent upon Europe—Want of trained skill—Our cotton and woollen fabrics superior—Pottery and other articles from abroad—The material produced in the United States purchased back—Russia and other countries—Art pervades all things—Political economy—Its maxims—American taste for luxury—Cheap lands scarcer—Industrial classes must rely upon trades—Effect of making what we need—Adam Smith on home-trade—We should acquire skill—Raise wages—Raw material in the United States—Causes of national prosperity—Our natural resources—Practical education—Linen, hemp, wool—Other articles—Effect of training industrial classes—The value put on material by art—Its general effect—New England—Massachusetts—Arts and manufactures of—Education in—The Worcester Free Institute—The Illinois Industrial University.

WE cannot turn to our own country without deep anxiety, for the subject of industrial education has a special interest for the people of the United States. The wealth and prosperity of the nation essentially depend upon the extent and perfection of its industry.

No modern people, with a country so rich in its own resources, has cultivated less sparingly its peculiar energies. Indeed, an effort to convince our representative men of the necessity of industrial education is regarded as an equivocal innovation, and in many quarters is met with a discouraging sneer; and it is suggested that American enterprise and pluck will supply the deficiencies of ignorance. The example of other nations should

serve to rouse us to a sense of our condition, or we shall be subjected to all the consequences of a dangerous foreign rivalry. With the means of supplying ourselves, we lavish our treasure upon other countries for commodities which could be made by our own artisans, if they were properly instructed in the theoretical knowledge of their art. The natural resources of the countries upon whom we lavish such immense sums are greatly inferior to our own ; but, by their system of educational training, they have raised themselves to wealth, and made us dependent upon them to supply a considerable portion of our wants and luxuries. Switzerland, with its sterile rocks and arid mountains ; Germany, with little naturally to rely upon, except its sleepless toil and patient industry ; France, that had no common school until now ; and England, that cannot produce food to feed her own people—furnish us with such immense quantities of things and conveniences as almost to defy belief ; and our importing merchants have their agents ransacking the industries of Europe for the regulation of our markets and the disposition of our resources.

Our industries are supplanted by those abroad for want of well-trained mechanical skill at home ; and this will continue, to our superlative disadvantage, until we become convinced of the necessity of educational development in our workshops.

What we need in this country is a correct public opinion on the relation of education to industry. When this becomes a subject of general interest, a great increase of material prosperity may be confidently expected, the interchange of the products of ingenuity will be indefinitely extended, and the influence of individual industry upon the general welfare will be widely felt.

r The cotton fabrics of the American loom are perhaps superior to those of other nations; and yet we import from foreign countries cotton goods of inferior quality, because their dyers, designers, and printers can produce a finer appearance and more striking effect on account of their artistic training. Our woolen manufactures excel in durability and firmness, and are now made from material grown in our own country; and yet, from the coat of the rich man to the shawl of the lady, whenever fineness and delicacy are wanted, or brilliant coloring, or tasteful design, the foreign fabric maintains its superiority. Our finest articles of pottery, porcelain, and delft-ware, a great part of our cambrics and muslins, velvets and silks, ribbons and laces, ladies' dresses and shoes, articles of bronze and glass, leather-work, and ornaments of every description, together with a thousand nameless articles of luxury and convenience, must still make a voyage across the Atlantic before we can use them.

It is interesting, in this connection, to remember that the raw material in a considerable part of these commodities is produced in this country, especially cotton, wool, and leather, and exported to Europe, and returned here to be purchased by us at four or five times the price which we received for it. As a consequence, the skilled labor abroad receives the benefit of this prodigious increase of its value, while our own people, perhaps, remain without employment, because they do not possess the necessary skill to produce it. Educate our own people in the knowledge of these beautiful industries, and, instead of paying this vast tribute abroad, we should give employment to millions of our own citizens, keep alive the spirit of enterprise, give new life to our manufactures,

and build up great seats of industry, such as have followed from the same cause elsewhere.

At one time Russia, seeing the advantage of creating a home market for her own people, prohibited, under penalty of confiscation, the importation of all those articles which could be manufactured at home. She has more recently, as we have seen, discovered a better way by which her own people can work up her raw material, and reap the benefit of their industry. Her rulers have instituted a grand system of technical education, with the noble Imperial Technical School of Moscow at the head of the organization, and still others of lesser grade, for teaching trades to her youth. Indeed, it may now be said that there is no civilized community which has not recognized the necessity of this policy. Spain, Portugal, and Italy, Sweden, Denmark, and Austria, have adopted a similar course, and vie with each other in the means they offer to instruct those engaged in carrying on their national industries. No better means could be devised for improving the social condition of workmen or advancing the general progress of society, for art now pervades all the various pursuits of life. The abstract speculations of political economy support a system of training which would produce skilled workmen for our various industries. It must be admitted by all that we should not send abroad for articles of consumption which we can manufacture or produce as well and as cheaply at home. It seems to be an axiom that foreign commerce only produces riches when the amount of the exportations exceed in value what are imported; and it is claimed that the country having this balance in its favor is conducting a profitable traffic. The converse of this proposition is also very generally

received as a current maxim, viz, that the country which buys more than it sells is doing a losing business, and will become poorer and poorer as long as it deals at this disadvantage. It is like the man who spends more than his income, and must of necessity make up the deficiency out of the balance of his estate, if he has one, or run into insolvency if he has not one.

According to this theory, our trade with other countries is carried on by changing our products for their manufactures as far as they are of reciprocal value, and receiving the balance in cash; and as this balance for several years has been very large, our increase in wealth has been enormous. Our exports have consisted principally though not entirely of breadstuffs, meats, petroleum, cotton, and tobacco, while the range of imports embrace such an array of manufactured articles that it would be extremely difficult to enumerate them. The disposition of the Americans to purchase articles of taste and luxury has kept pace with our prosperity, and the demand has stimulated every branch of industry in the United States and many of those in Europe. It is becoming a necessity that our own artisans should supply this ever-increasing demand to supply the wants and tastes of these fifty millions of people. The time was when the industrial classes employed the savings of their wages in the purchase of cheap lands for cultivation; but that is no longer practical. Our cheap lands for cultivation are becoming scarcer and more remote every year. Vast areas are in the hands of individuals and corporations, and the operations of agriculture are wrought by costly machines which have revolutionized the old system of tillage, and introduced an inconceivable rapidity and cheapness

of labor. A considerable amount of capital is now indispensable in order to compete successfully in farming. The cultivation of the land cannot be attained on such easy terms as when it was nearer and more abundant, and it has consequently almost ceased to attract those employed in other pursuits. Our industrious classes will therefore have to rely more and more upon their trades for the means of subsistence, and the proposition is maintained that the best means of securing this end and of increasing the general industry of society is to train and educate them properly in the art of producing, in our own towns and cities, articles of as good quality and as attractive in appearance as those which are imported. The vast amounts which are now expended upon foreign labor would, in that case, be distributed among home industries, and would greatly multiply domestic employments; while the effect upon all branches of trade, such as the baker, the butcher, the merchant, and the banker, the farmers, the laborers, those who live in the country, and those who dwell in the cities, every class and every interest in society, would be to benefit them all in an extraordinary degree, and to substitute industry for idleness, and skill for ignorance, in the useful pursuits of life.

Adam Smith lays down some views very pertinent to this point when he says: "But a capital employed in the home-trade, it has already been shown, necessarily puts into motion a greater quantity of domestic industry, and gives revenue and employment to a greater number of the inhabitants of the country, than an equal capital employed in the foreign trade of consumption, and one employed in the foreign trade has the same advantage over an equal capital employed in the carrying-trade.

Upon equal or nearly equal profits, therefore, every individual naturally inclines to employ his capital in the manner in which it is likely to afford the greatest support to domestic industry, and to give revenue and employment to the greatest number of people in his own country." *

These remarks, from the highest authority among the advocates of free trade, may be unreservedly accepted by the friends of industrial education. They express sentiments to which we desire to give the greatest prominence, for, if the natural conditions are favorable, it is better to produce what is wanted at home than to import it. It is no answer to reply to a proposition so plain that we are striving for a Utopian condition, in which we will sell everything and buy nothing. It is a lesson of practical wisdom not to subordinate incessantly our own industries and our own markets to those abroad, and to place ourselves at the mercy of every foreign enterprise against our industrial independence, under the specious pretext of maintaining a system of free trade. If any country excels us in the manufacture of any kind of goods which we need or desire, their influx here is inevitable; but if we have the natural productions and the climate in our favor, and only lack the manufacturing skill, would it not be wise to acquire that skill, and by that means establish a domestic industry which would benefit the whole country, rather than to drive a branch of foreign trade which is profitable only to foreign labor? Our imports might be diminished, but the national industry would be augmented, and the particular kind of goods increased among our own people, while the change would furnish new

* "Wealth of Nations," book iv, chapter ii.

employments and raise the wages of labor without increasing prices, for high-paid labor is the cheapest in the long run when it is the offspring of skill and science. We will get to know the necessity of this conduct when we can no longer misunderstand the danger of neglecting it. In all countries where the useful arts have made large progress, such as England, France, and the United States, the productions will be nearly if not quite similar in kind, differing only in quality and salability: thus, cotton and woolen goods, linens, silks, iron, steel, copper, jewelry, porcelain, etc., are manufactured in each of these countries, and it is childish to affirm that the natural conditions in regard to these commodities are not so favorable with the last as with the two others. It is by improvement in the arts of production that they have acquired a superiority and influenced the trade of the commercial world to their advantage. This advantage will preponderate heavily in favor of both England and France as long as we neglect the means which have operated wherever the higher industries have flourished. There are other causes which influence the growth of a nation's prosperity; the price of land, the cheapness of living, the natural productions of the soil, the effect of climate, and the cost of the raw material, are not the same in all countries, and the one favored by Nature most abundantly will possess certain economic advantages as compared with the others. We can compare the natural resources of the United States with those of any other country. All the materials for economic aggrandizement are displayed in the vast regions we inhabit; our people are hardy, ingenious, and intelligent, either in peace or war. Relying upon these, we have done little or nothing

for the scientific training of skilled workmen, without which our magnificent inheritance is in great part rendered of no avail. The moment has come when we must take a firm and solid step for practical education. Elementary education is no longer a question. It is a matter of knowing what can be done by way of applying it to the useful pursuits of the people who work. It is a subject in which all citizens of all parties have an interest. When other countries are raising the standard of workmanship higher and higher, why should we occupy ourselves only with the incoherencies of discussion, the embarrassments of supplying our wants abroad, and in talking of reform?

Suppose we manufactured our own linen, it would stimulate the supply of flax, which can be grown in the United States of as good quality as in Europe; and laborers now idle by the thousand might cultivate the crops on land now unused; while mills and operatives to manufacture the fabric and the machinery will introduce a great industry. So of hemp, of wool and woollen goods, in the production of which we might soon excel the Asiatics by the use of ingenious machines, thereby offsetting their prodigious supply of manual labor. We import vast quantities of iron, steel, copper, lead, zinc, and the beautiful articles into which all the metals are fabricated, and yet these materials are found in widely-diffused abundance within our own limits. And sometimes it happens that multitudes of our own people are suffering for want of work, for the simple reason that there is greater skill used abroad in these trades than that which our own workmen have an opportunity of acquiring.

The same holds true in regard to fine porcelain, silks,

jewelry, and countless other utilities, which can only be produced by skilled labor and mechanical science.

In commenting upon the necessity of industrial education there is no reference intended to the effects of free trade or protection. Nothing is more common than the discussion of that question; but the object of this work is to point out the general necessity of training the industrial classes to act intelligently upon all industrial objects, to make them self-reliant, and ready to put forth all their energies to the greatest advantage, and to qualify them to contend successfully with the practical dilemmas of their every-day business. This condition will also be valuable as preparatory of further advances in the useful, the ornamental, and the fine arts, for it will represent a transitional period in the evolution of grander inventions and more intellectual arts, which will relieve labor and elevate human intelligence.

We have seen the effects in Europe of art-education in diffusing the spirit of general improvement among the mechanic and manufacturing industries. It is possible to trace to this source the growth and enlargement of wealth and prosperity in the industrial nations. Indeed, art is the origin of the first price we pay for all things. This is especially apparent in those wonderful triumphs of human ingenuity where it has conferred upon materials of the most trivial cost a value almost beyond belief. A bale of cotton is computed to be worth five hundred dollars; but when manufactured, it is supposed to be worth two thousand dollars. The baser metals are often converted, by mechanical art and skill, into forms which assume a value exceeding their weight in gold. Owing to a peculiarity in our domestic habits, the use of glass is

immensely extended. The materials of which it is composed may be said intrinsically to be of no value. Not only for table-service, window-glass, and mirrors, but also for lamps, chimneys, globes, shades, chandeliers, and enameled work, the market in this country is practically without limit. Our manufacturers have acquired great proficiency, equaling and often surpassing, in strength and beauty, any of that made abroad. We have the best material possible; and there is no reason why these beautiful fabrics, unless from want of artistic skill, should be imported; yet four millions worth of imported glass was consumed last year (1881) in the United States.

Now, the enormous increase in the value of the raw material is realized by the community in which it is manufactured. In producing this change, art adapts its properties to human use; the labor of many persons is required; it gives employment to both sexes and to various grades of industry and skill, and contributes equally to commercial prosperity, intellectual progress, national wealth, and the beauty and refinement of civilized life. Other collateral industries grow up in the neighborhood to provide the necessary machinery, tools, and buildings. The village soon becomes a populous city; the useful arts increase in variety, the lands rise in value, and the real wealth of the nation is wonderfully enhanced.

The whole of New England may be chosen as an illustration, for there the advancement of useful art has been the most remarkable in the United States. Mr. Preston, of South Carolina, in a speech made many years ago, declared that the only natural productions for exportation from Massachusetts were granite and ice. Per-

haps there is no spot in the land where Nature has provided so scantily and exacted so much, to make it the abode of industry, and yet there is scarcely any other in the present age where so vast a trade has been managed; nay, it is not too much to say that her industries are more mixed and varied than those of any other quarter of the globe of the same narrow compass. Her cotton, her wool, her iron, the elements upon which she works; and her corn, and wheat, and cattle, upon which she depends for food—all come from States more favored by soil and climate. And whoever has traveled in New England and observed the number of its great and populous towns, and the splendid improvements of almost every spot of ground; the multitudes constantly employed in her factories, her furnaces, and workshops, and the numbers of her people, all active and busy, may wonder, perhaps, at the foundation of her success, for we must know that she could not grow rich by exporting granite and ice. The ingredients of life and success are few and simple. New England grew rich by force of industry, by improvement, by education, and the manufacture of the natural growths of other States, and by furnishing all parts of the country with whatever their wants or their markets demanded or invited; and thus, by her own right arm, she forced the greatness of her profits to make amends for the stinginess of Nature.

In those districts which have become the seats of great industries we often find an immense increase in population and wealth, and, if we do not find a corresponding advance in the education of the people, they are apt to become overgrown masses of ignorance and moral corruption. All accounts agree in ascribing this character to

the crowded manufactories of England, previous to a time, quite recent, when the spirit of the whole kingdom became roused up to the necessity of a system of public teaching for the benefit of the industrial classes. On the other hand, in Massachusetts the maxim was early adopted, and has been continually enforced in every period of her history, that the more cultivated a man's intellect is the more productive is his labor and the better his life. There is a commercial as well as a moral value in knowledge, for it refines all the senses and passions of the soul, and by an inevitable tendency elevates the whole of our humanity. Of this she is a striking example. Her products have not only enriched her at home, but her ideas are as prevalent and wide-spread as her notions; she furnishes every quarter of our extended country with teachers in schools and colleges, and thus imbues our American youth with her educational methods and thoughts. There is scarcely a business establishment where her skilled workmen are not found, and in all the cities and towns of the Middle and Western States her sons hold the first rank in position and influence; they fill the learned professions, lead in commercial industry, and explore every avenue of art, trade, and wealth. Indeed, the advantages she has obtained constitute a splendid monument for her immense efforts in educating her people. As she was the first in the world to establish a system of common schools, so is she also the first, or at least among the first, to afford an example of an institution for the promotion of industrial science.

The Worcester Free Institute was founded in 1865, by John Boynton, a citizen of Templeton, Worcester County, Massachusetts, who gave the sum of one hundred thousand

dollars for its endowment and support. In his deed of gift he says: "The aim of this school shall ever be the instruction of youth in those branches of education, not usually taught in the public schools, which are essential and best adapted to train the young for practical life, and especially that such as are intending to be mechanics, or manufacturers, or farmers, may attain an understanding of the principle of science applicable to their pursuits, and will qualify them in the best manner for an intelligent and successful prosecution of their business; and that such as intend to devote themselves to any of the branches of mercantile business shall in like manner be instructed in those parts of learning most serviceable to them; and that such as design to become teachers of common schools may be in the best manner fitted for their calling; and the various schemes of study and courses of instruction shall always be in accordance with this fundamental design, so as thereby to meet a want which our public schools have hitherto but inadequately supplied." The Hon. Stephen Salisbury made an additional gift of two hundred thousand dollars, and said, "This school will not attempt to turn out in this short period an Arkwright, a Stephenson, or a Fulton, but it may give facilities and helps which these great mechanics did not possess."

The Hon. Ichabod Washburn, of Worcester, gave the institute a machine-shop and provided it with its equipments and a fund of five thousand dollars to be expended for stock, and the interest of fifty thousand dollars to provide for contingencies. Besides all these advantages, the locality of the school is highly favorable, for the whole neighborhood is extensively engaged in manufacturing arts and trades of every description. I make a

brief extract from the catalogue of 1880, as follows: "The institute has graduated nine classes, aggregating one hundred and eighty-six students. The ease with which more than ninety per cent of these young men have secured honorable and lucrative employment, in stations for which their training especially prepared them, confirms the confidence of the trustees in the soundness of the general principles upon which the school is organized."

Candidates for admission must give evidence of proficiency in the common English branches of learning. The course of study embraces a period of three years, and, while some studies are pursued by all the classes alike, every student has to select at some time during the first year some department in which he must devote ten hours a week to practice until his graduation—that is to say, for two and a half years' students who select chemistry, work in the laboratory; the civil engineers, at field-work or problems in construction; those who select drawing, in the drawing-room; and those who select physics, in the physical laboratory. The mechanical section practice in the workshop to the end of the term; and after the latter have been sufficiently advanced they receive instruction in designing machinery, and undertake the building of one or more complete machines from their own drawing. The class of last year constructed a Corliss engine; the class of 1880 made an upright reversible engine. Indeed, all the facilities of a first-rate machine-shop are offered to the students in this section for obtaining a practical knowledge of the use of tools, the management of machines, and the theory of their construction. In a word, the institution is designed to meet the wants of

those who wish to be prepared as mechanics, civil engineers, chemists, or designers, for the duties of active life with the advantages of a solid education.

The Illinois Industrial University, located at Urbana, Champaign County, Illinois, had its origin in this movement for the higher education of the industrial classes. It is even more richly endowed than the Free Institute at Worcester, and to the union of most of the excellences of the latter it adds many of those belonging to a university. It has a college of agriculture, in which to educate agriculturists and horticulturists; a stock-farm; an experimental farm, with all the apparatus and breeds of cattle; together with nurseries, orchards, exotics, green-houses, gardens, and all that can give practical knowledge in farming and aid in the development of an agricultural science. In the college of engineering is the school of mechanical engineering. It aims to fit the students to invent, design, construct, and manage machinery for any branch of manufacture; and the need for men is recognized, who, to a thorough knowledge of the principles of machinery and of the various motors, add the practical skill necessary to design and construct the machines by which these motors are made to work. There is also a college of natural science and one of literature and science; to these are added a school of military science, and a school of art and design. This last school is represented in the catalogue as having a twofold purpose: 1. It affords to the students in the several colleges the opportunity to acquire such knowledge of free-hand drawing as their chosen course may require. 2. It affords to such as have a talent or taste for art, the best facilities for pursuing studies in industrial design-

ing or other branches of fine art. Schools of design in Europe and in this country have been found important aids to the higher manufactures, adding to the beauty of fabric and to the skill and taste of workmen. The increased interest in the decorative arts and in the manufactures which they require, has added new importance to the study of drawing and designing. It is the purpose to keep this school of design abreast with the best movements in this direction. The text-books, cabinets, museum, gallery of fine arts, laboratories, and workshops—indeed, the whole course of studies and the ample staff of teachers and assistants—all bear testimony to the practical character of the institution, and the careful attention bestowed upon everything connected with the successful prosecution of the original design of the founders.

CHAPTER V.

Technical schools in the United States—Massachusetts Institute of Technology—Manual School, Washington University—Stevens Institute of Technology—The usefulness of these in this country—Scheme of the Massachusetts Institute of Technology, and course of study—General Walker on science schools—The School of Mechanics therein, and its course of instruction—Mr. Folcy's report—Russian plan of manual teaching—The use of hand-tools still necessary—The Manual School in Washington University, St. Louis—Its plan of teaching shop-work—Pennsylvania Museum and School of Industrial Art—Other technical schools in Philadelphia—Science schools attached to universities—Agriculture and mechanical colleges under land grants—Some statistics concerning them—In order to be useful, they must teach by practice—The Massachusetts Institute of Technology a good example—Institutions for the superior education of women—The number of such schools in the United States—Every facility should be afforded for their education—Brief discussion on this subject—Their employment as farmers, decorators, and architects—The numerous trades open to women—Emily Faithful's views—Industrial education of women—Equality of Education—Co-education—Should women pursue the old system of college studies?—This is a utilitarian era—Victor Cousin on the fine arts—Auguste Comte on science—Other thinkers—The Greeks can be studied without studying Greek—Should girls pursue the same studies as the boys, in matters of superior education?—Advantages of industrial education to women.

THERE are several technical schools in the United States, similar in character to the science and polytechnic schools in Europe—such as the Massachusetts Institute of Technology in Boston, the Polytechnic School of Washington University at St. Louis, and the Stevens

Institute of Technology at Hoboken, New Jersey. The studies in each extend through a period of four years, and are to prepare the pupils in the various branches of professional engineering, architecture, and chemistry. A series of workshops are now attached to each of them for instruction in practical mechanics and the use of tools in wood and iron-work, so that, when the courses are completed, the students are prepared by experimental knowledge to engage at once in their chosen occupation. The studies are pretty much the same in all the classes during the first year, and the students then take the course adapted to their future pursuits. It is somewhat different at the institute in Hoboken, as mechanical engineering is there the only special study.

Without going into particulars, it may be briefly said that the object in these schools is the special and thorough training of engineers, architects, and chemists, in attainments far advanced beyond the means or knowledge possessed by our colleges or universities. This system of teaching is called technical, because it involves the application of constructive principles with the greatest exactness in mechanical structure as well as in execution, so that the mechanic and engineer can meet the wants of their professions without the mistakes which usually arise when experiments are conducted in ignorance of the principles of mechanical powers or motors. Schools of this kind are therefore designed for professional purposes and professional men alone. And in a country having the longest and most elevated bridges in the world, the most extended railroads, a system of internal improvements that spans the continent, together with the cultivation of a steam-power that plows up both land and sea, and has

created an era in every branch of human activity—to say nothing of our inventions, our mining, metallurgic, and manufacturing interests, and our perfectly adjusted and delicate machinery, which ranks among the wonders of the world—it is, I say, among the most practical and useful aids to our progress that men should be in the leading places who are learned in all that is known of natural and mechanical philosophy. And it is gratifying to know that teaching to this end has been attended with triumphant results, and that our young men with scientific bias need no longer resort to the schools of Europe to learn the principles of economic science.

The main scheme of the Massachusetts Institute of Technology is to afford instruction adapted to the wants of those who will be engaged in professional pursuits, in which a knowledge of some branch of applied science is useful or indispensable. Its regular curriculum comprises nine courses, viz., one in civil and topographical engineering; one in mechanical engineering; one in mining engineering, or geology and mining; one in building and architecture; one in chemistry; one in metallurgy; one in natural history; one in physics, and a general course containing several subdivisions. Many other branches are also established, such as mathematics, the French and German languages, English history and literature, political science, international law, mechanical drawing, stone-cutting, microscopy, photography, mechanics, electricity, and a very great list of other details and subjects of study, the mere statement of which occupies fourteen printed pages in the catalogue of 1882-'83. Indeed, there is no branch of science, as applied to industry, which is not embraced in the courses.

To aid the students in gaining the knowledge specially adapted to their intended professions, there are attached to the institute museums, collections in natural history, geology, and mineralogy, laboratories, and workshops, mechanical patterns, and machinery of various kinds, all of which are used to illustrate practically the theory and principles of industrial science. In aid of the practical studies of the school, and as a means of familiarizing the students with the actual details of their studies, they are required, in term-time, to make visits of inspection to machine-shops, mills, furnaces, and chemical works, and to visit important buildings and engineering constructions within convenient reach, and in vacations more extended excursions are made for the survey of mines and geological features, and for the study of metallurgical works and noted specimens of engineering.

The students in the course of mechanical engineering are required to devote a considerable amount of time to work in carpentry, wood-turning, pattern-making, molding and casting, forging, chipping and filing, and planing and turning the metals ; and all the students in the other departments are allowed to take shop-work when the time will not interfere with their regular studies. The shops and laboratories have been provided with the more important hand and machine tools, so that they can acquire a direct knowledge of the nature of metals and woods, and some manual skill in the use of tools and of applying science required in a variety of mechanic arts. The courses of the institute extend through four years, and for proficiency in any one of them the degree of bachelor of science is conferred, and the degree of doctor of science has been authorized for advanced courses of study.

From this brief account, it is seen that the Massachusetts Institute of Technology is devoted to the higher training in utilitarian science, and to the cultivation of the intellectual faculties so as to harmonize the objects of education with the wants and requirements of the age ; and I think it is not extravagant to say that its rich and varied programmes of study and the attainments and devotion of its instructors will compare favorably with many of the polytechnic schools in Europe, upon which such immense sums have been expended.

Concerning the particular standing of science schools in our educational system, General Francis A. Walker, who is at the head of this one, is reported recently to have said :

“I would have the highest class of schools that teach industrial or mechanical work like our own institute, the Sheffield School at Yale, and the Troy Polytechnic, and the classical or literary universities and colleges in the same grade, the graduates of the mechanic schools conceded the same standing and as much social recognition as the bachelors of arts receive from the world. The primary and grammar and high schools should teach the rudiments of mechanics as they do the elements of letters, so that those who choose to enter the industrial colleges shall have that preparation that is essential to success in the higher courses pursued there.”

The suggestion here made comes from one who has a correct appreciation of the value and purpose of practical education. The method he proposes would familiarize the students in the grammar and high schools, who desire to be received into the technical schools, in the elements of mathematics, chemistry, drawing, and mechanics, and

would enable them to pass at once into the full benefits of technical lessons. The importance of previous preparation is as obvious in regard to these institutions as to those of a merely literary character.

It is a marked feature in this school that, although near the oldest seat of learning in this country, it has broken away from the beaten track and teaches the material forces of the physical world instead of the verbal learning of the ancient one. It recognizes and honors the vital importance of the new professional callings and scholarship which arise out of the altered social condition of men, and from the progress of scientific discovery to which the world mainly owes its present advanced condition. It was planned and organized to imbue its pupils with a proper sense of and skill in the great achievements of modern art; and its great service in the work of real knowledge will at no distant day elevate it to the educational rank and honor of the other colleges and universities.

But the feature of this school which is particularly germane to our subject is the mechanical branch, with a two years' course which takes the form of systematic shop-work, and which is designed for the instruction of those who wish to enter upon industrial pursuits rather than to become scientific engineers. Many can not afford the time and cost for the professional courses who intend to follow some one of the mechanic arts, either as a skilled workman or as a master-mechanic. All such who have completed an ordinary grammar-school course may enter the school of mechanics, and continue their general studies in algebra, geometry, physics, drawing, and French, while a considerable portion of their time will be devoted

to learning the use of the typical hand and machine tools for working in wood and iron. "The shop-work is conducted upon a plan designed at the Imperial Technical School at Moscow, Russia, and carried out there with most satisfactory results. . . . Its exact and systematic method affords the direct advantages of training the hand and eye for accurate and efficient service with the greatest economy of time, and the instruction in the use of tools and materials has also proved a valuable aid in intellectual development."

During the first year instruction is given in carpentry and joinery, wood-turning, pattern-making, and foundry-work; in the second year, iron-forging, vise-work, and machine-tools work. Nine hours per week—three lessons of three hours each—are devoted to shop-work and the balance to other studies, only one shop course, except in the case of special shop-students (for whom provision is made), being carried on at a time.

A view of the interior of the workshops is presented in the "Special Report of the Bureau of Education" on the subject of industrial education, commencing at page 148, and a series of models is also represented, and numerous cuts of pieces used in the course of instruction, which convey some idea of their arrangements and the means they contain for the practical work of the school. There are sixteen molding-benches in the foundry, combined with troughs for holding sand, and a cupola-furnace, and over it a Sturtevant fan which exhausts the heat and dust from the blacksmith-shop beyond. The forging-shop is fitted with eight forges and two Sturtevant blowers for pressure and exhausting. The machine-tool shop contains sixteen engine-lathes of four and a half feet bed, four

speed-lathes, and a Brainard milling-machine. Under each lathe is a chest of drawers to hold the tools belonging to the student using it. The chipping, filing, and filling shop contains benches with sixteen vises and other needful appliances, with a planer and grindstone.

The work of manual instruction, however, commences in the shop for carpentry, joinery, wood-turning, and patterns; and it contains lathes, benches, chests for holding the tools, and saws for cutting up the lumber to the dimensions needed in the course of the work. First comes the use of the saw, and then a series of thirteen elements follow, such as a square joint, a miter-joint, a dovetail joint, etc., and each student makes a frame to apply several of these elements. This is succeeded by turning, pattern-making, and a series of manipulations incident to the course of instruction. There is also a blacksmith-shop, and rooms for chemical and microscopical laboratories, a dark room for spectroscope, and one for pattern-weaving, which is provided with five looms, one of them a twenty-harness and four-shuttle loom, and another an improved Jacquard-pattern loom; and it is intended to include other branches and departments as soon as circumstances will justify it.

It is, of course, a matter of great interest to determine what has been the experience of the school and the result of its work. Upon this point I take from the same report the statements of Mr. Thomas Foley, who is in charge of the forging vise-work and machine-tool work. He says:

“The system of apprenticeship at the present day, as a general rule, amounts to very little for the apprentice, considering the length of time he must devote to the

learning of his trade. He is kept upon such work as will profit his employer, who thus protects himself. If the apprentice should be thoroughly taught all branches in the shortest time, he would be likely to leave as soon as he could do better, letting his employer suffer the loss of time devoted to his instruction.

“Now, it appears like throwing away two or three years of one’s life to attain a knowledge of any business that can be acquired in the short space of twelve or thirteen days by a proper course of instruction. The dexterity that comes from practice can be reached as quickly after the twelve days’ instruction as after the two or more years spent, as an apprentice, under the adverse circumstances spoken of above. The plan here is to give to the student the fundamental principles in such lessons as will teach them most clearly, and give practice enough in the shortest time to acquire a knowledge of the different kinds of tools and various ways of using them. For instance, if a man can make a small article in iron, steel, or any other material perfectly by such methods, he can make it of larger proportions with the additional time and help required for such an undertaking. The same in degrees of heat required for fusing or welding metals: if he can do it well in a lesser degree, he can certainly do so in a greater, with the additional facilities.

“After nearly five years’ experience in the workshops in my charge, with the valuable suggestions of the professors so much interested in the success of the school, we find the best results in the time allowed accomplished by the method now in use in the institute workshops, viz., three lessons per week of three hours each.

“The time is just sufficient to create a vigorous inter-

est, without tiring; it also leaves a more lasting impression than by taxing the physical powers for a longer period. We have tried four hours a day, and find that a larger amount of work and of better quality can be produced in the three-hour lessons.

“In order to give each student the proper credit and to show him the most important points in each piece, the following method has been adopted for inspection. Take case of bending, the points to be noted by the student are rated as follows:

Dimensions	25
Form	70
Finish	5
	100

“The most important point in this lesson is the form, the next the dimensions, and the last the finish. Through all the iron-working and other metals in each shop the same method is carried out. Every piece is made to certain dimensions laid down upon the drawing. The object of working to dimensions is to establish the necessity of correctness in measurement, and is followed throughout the course as a very essential point. The most of the exercises convey the idea of the necessity of straight lines in drawing or lengthening iron and graceful curves in bending.”

Mention was made in this account that “the shop-work is conducted upon a plan designed at the Imperial Technical School of Moscow, Russia,” commonly called the Russian plan. The workshop system of instruction at the Massachusetts Institute of Technology is seemingly prepared

with the same deliberation and exactness. Its whole structure and prospective means of usefulness are apparently suggested by the Russian exhibits at the great international expositions.

The corner-stone of this plan rests on the faculty of induction—that is, a succession of studies in regular sequence; one step leading naturally to the next, to the end of the course. When the student understands the theory of one task, and can perform it with skill, he is put to doing something else. His interest never flags, because his work never becomes mere routine or wearisome. Single trades are not taught, but the principles common to all trades are assiduously inculcated, and are at the same time illustrated practically in the workshop. The student learns the nature of the materials upon which he labors, and the processes by which articles of value are wrought through mechanical skill and art. It is the same with the theory and use of tools. The functions of the axe, the saw, the plane, the hammer, the chisel, the file, etc., are fully and repeatedly explained by competent teachers and skilled workmen, until the science of manipulation is thoroughly understood, and all the varied forms into which these simple elements can be combined by mechanical skill and ingenuity.

We know, however, that mechanical movements have greatly abridged the use of mere hand-tools, especially in the manufacturing arts. Masses of red-hot iron are wrought into the desired form by machine-hammers. The needle and the awl have been converted into machines that close up seams with an accuracy beyond the reach of human muscle; and instead of the hand-shuttle, the power-loom now weaves our textile fabrics with all

the variety and beauty required by modern fastidiousness. Machinery drives the sharp tool in the planing-mill and the delicate one of the Waltham watch-maker. Notwithstanding this, hand-tools are still the bases of all industrial art. Their actual use is still necessary for many important purposes. In fitting, finishing, and modeling, they are indispensable; and it is equally true that the contrivances we call machine-tools are the same in principle as those which are used by the hand of man. They have prodigiously increased productive efficiency, and given greater accuracy to mechanical constructions; but whether the tool is used by the hand or placed in a frame, it is still a tool, and presents the same principle of mechanics. Says Mr. Knight: "Neither the tool nor the machine has any force of itself. In one case the force is in the arm; in the other in the water, the steam, or the animal that turns the wheel. The distinctions which have been taken between a tool and a machine are really so trivial, and the line of separation between one and the other is so slight, that we can only speak of both as common instruments for adding to the efficiency of labor." Indeed, we can hardly form a mental picture of a people without tools; and if we should forget their use, it would not be very long before we should have but few of the characteristics of civilization, and all the mechanical giants of our arts and industry would cease to exist within a single generation.

The science of tools is therefore imperative, and this is realized in the programmes of hand-labor instruction which form so prominent a feature in the technical schools at the two Russian capitals, and is regarded as matter of the utmost importance in counteracting the de-

teriorating effect of specially adapted machinery in the division of labor.

The whole plan of study received such flattering testimonials at the expositions, and has excited such a remarkable degree of interest among the friends of industrial education, that notwithstanding its length I feel justified in adding, by way of appendix to this chapter, the account of the school at Moscow by its director, M. Victor Della Vos, as the best statement of the practical details and arguments in favor of that method.

A school for manual instruction was also established in 1879 as a permanent branch or part of the Washington University at St. Louis, in which the students divide their working-hours as nearly as possible between mental and manual exercises. As this is one of the few manual training-schools which have been attached to any university or college in the United States, and as, moreover, it is claimed to be a successful application of the Russian plan, it may be permitted to present with some detail the programme of exercises for the pupils.

The course of studies covers three years. In mental training, instruction is thorough but not extended, and would probably correspond with that of our high-schools. English language and literature are the only philological studies in the course.

In manual training, special attention is paid to drawing throughout, embracing three general divisions—free-hand drawing, mechanical drawing, and technical drawing or draughting—illustrating conventional colors and signs, and systems of architecture or shop-drawings.

Workshop instruction is given in a carpenter-shop, a turning-shop, a machine-shop, and a blacksmith-shop. All

the machinery is driven by a fine Corliss steam-engine. The theory of workshop instruction is so completely set forth in the annual catalogue of 1881-'82, and the argument in favor of applying education to industry, is so carefully and clearly stated, that notwithstanding the space it may occupy it is thought desirable to give it at some length.

The results of experience have abundantly confirmed the views of the managers of the school, and they declare that—

The zeal and enthusiasm of the students have been developed to a most gratifying degree, extending into all the departments of work. The variety afforded by the daily programme has had the moral and intellectual effect expected, and an unusual degree of sober earnestness has been shown. Success in drawing, or shop-work, has often had the effect of arousing the ambition in mathematics and history, and *vice versa*.

Progress in the two subjects, drawing and shop-work (and we had little previous knowledge of what could be done with boys as young as these of the first-year class), has been quite remarkable. To be sure there was no doubt of the final result, but the progress has been more rapid than it seemed reasonable to expect. The second-year class contains already several excellent draughtsmen, and not a few pattern-makers of accuracy and skill. The habit of working from drawings and to nice measurements has given the students a confidence in themselves altogether new. This is shown in the readiness with which they undertake the execution of small commissions in behalf of the school, or for the students of other departments. In fact, the increased usefulness of our students is making itself felt at home, and in several instances the result has been the offer of business positions too tempting to be rejected. This drawback, if it can be called one, the school must always suffer. The better educated

and trained our students become, the stronger will be the temptations offered to them outside, and the more difficult it will be for us to hold them through the course.

Parents and guardians should avoid the bad policy of injuring the prospects of a promising son or ward, by grasping a small present pecuniary advantage, at the cost of far greater rewards in the future.

In another important respect, our expectations have been more than realized; namely, in our ability to introduce class-methods in giving instructions in the theory and use of tools.

All divisions in the shops have thus far been limited to twenty pupils, and, as a rule, all members of a division have just the same work.

The exercises have been two hours long, though often the students have asked for longer work. It is but due to the pupils of the school to say that they have uniformly seconded all efforts looking toward good order and good manners. No little surprise has been expressed by visitors, at seeing how quietly and independently twenty boys can work for a couple of hours in the same room. An examination of the rules, given on another page, will show the care and consideration expected of all during shop-practice. Though all classes handle keen-edged tools, no serious accident has happened, and very rarely have small injuries been received.

The splendid success of this institution is due to the skillful management of Professor C. W. Woodward, its director.

The Pennsylvania Museum and School of Industrial Art provides in the most comprehensive way an advanced education in the art of industrial design, especially for those who wish to take advantage of its facilities to obtain a thorough knowledge of the application of design to manufactures. The course consists of drawing, modeling, the study of color, and its application and disposition in

design, both in the round and in the flat. Descriptive geometry, as connected with drawing and design, together with free perspective, also forms a part of the course; and the students are called upon to prepare original designs applicable to industrial purposes in each of the branches studied. There is no charge for tuition, and either sex may be applicants for admission.

Several of the technical schools in Philadelphia exhibit a similar course of instruction, especially the Franklin Institute and the Spring Garden Institute, and the same plan is to be introduced into Girard College. These institutions are enlarging their facilities for promoting the application of science to the useful purposes of the mechanic arts, and are preparing the means to teach the students in the use of tools by the actual hand-work of construction.

The growing interest for practical education has reached some of the most distinguished universities and colleges in the country, the Lawrence Scientific School and the School of Mining and Practical Geology at Harvard, and similar institutions at Yale, Columbia, and Princeton show how grandly the new philosophy in teaching—scientific and industrial—has won its way into the most conservative and venerable seats of learning.

Among the newer generation of universities, Cornell in the East and Michigan University in the West, and the University of California on the Pacific, were founded upon modern opinions, and from the first they established courses of instruction, with university honors, for professional training in science and mechanics, in mathematics and design, and their application to agriculture, to hygiene and to the industrial arts; and they have already

attained very great credit by means of the work they have accomplished in these departments.

Agricultural and mechanical colleges in the several States which accepted the aid of the land grant made by Congress for their special endowment, have contributed largely to the movement for education in the industrial pursuits and professions of life. The leading object observed in these institutions is to teach such branches of learning as are related to agriculture and the mechanic arts. They were forty-eight in number in the year 1880, with several thousand students, a great part of whom pursue studies which deal with the industries. Nearly all of them have extensive farms, nurseries, gardens, and buildings for agricultural instruction, and a large number have also provided and equipped workshops in which both practice and instruction in the mechanic arts are systematically carried on. The report of the Commissioner of the Bureau of Education for the year 1880 gives a detailed statement of their condition, of their resources, courses of study, and attendance. The statistics show that during the previous ten years the number of instructors had doubled, and the students increased fourfold; that the graduates had multiplied, and generally entered upon industrial pursuits, or engaged in teaching. The whole number of schools of science and agricultural colleges in the United States is eighty-three, with 4,421 students in the scientific and industrial departments, or at the rate of nine per cent of the whole number of students in all the colleges and universities pursuing the regular programmes of classical learning.

If we do not conclude from these facts that technical education has approached a practical solution in this coun-

try, we can at least declare that it has made very great progress within the last few years, and that the many schools for its diffusion have been full of devotion to the noble interests confided to their care. We are yet on the threshold of these great educational reforms, and many problems and difficulties remain for definitive adjustment. But the technical schools are already a very interesting feature in our public instruction, and as they increase in material and moral resources will work and win their way. The colleges and universities have produced Greek and Latin scholars, or students in law, medicine, and theology. Henceforth, thanks to our technological institutions, there will be added to these learned professions, students in the industrial economics of life. This is great progress; technical education is an existing fact. It is solidly established. Public opinion goes with it; and it represents a notable reform in our educational methods. I trust the time is not far distant when our superior seats of learning will have attached to them mechanical branches, so that persons who have a mechanical bias can follow their inclination under the instruction of the most highly cultivated mechanicians in the world.

It must, however, be acknowledged that much of the usefulness of these institutions depends upon their intimate relation to the industries of the country. It is feared in some quarters that there is a tendency to produce men with a high order of mechanical knowledge, but who can not use the knowledge they possess because they have no practical skill in applying the principles they have learned; and who are, therefore, as much out of place in a workshop as any other persons whose hands have never been soiled by the handling of a tool. It is the application

of mechanical studies that is most needed, and it is this adaptation in practice which alone will save those studies from being viewed as a mere useless accomplishment. The deficiencies in our present system of education are said to consist in cramming the pupils with a great amount of indigestible information which can be turned to no practical account; and the same objection is even now occasionally heard in regard to technical education, for it is alleged that it communicates an incoherent mass of science without any skill in the workmanship to which it is applicable. Perhaps it is difficult to describe technical education; but one thing is sure, the pupils ought to be instructed in practice as well as in theory, so that they will not look down upon the application of their studies to the manual work which gives them their highest value.*

The Massachusetts Institute of Technology is an example of such practical instruction, because in addition to the study of science, drawing, and composition, nine hours shop-work every week is required of each class in carpentry, joinery, wood-turning, pattern-making, vise-work, forging, foundry-work, and machine-tool work in a course

* The object of technical education is to teach the actual method of working some particular trade to persons engaged or about to be engaged in that trade, but such method is to be taught in a scientific way, and theoretically rather than practically. Where practical work can be introduced to let the students test the theory as they go on, the technical instruction is by so much the better. By some persons it is held that unless some practical manual work is done by the students, the instruction is not really technical; but this seems to me to restrict the term too much. But be this as it may, it is the essence of technical education to teach the theory of a trade, and, if possible, to illustrate it by practical work at the same time, in order that the student may be both theoretically and practically familiar with the business he intends to follow.—*Address of W. S. R. McLaren.*

of two years. The students go forth from the institution with something better than theories of this or that school, or of this or that plan. They are prepared for practical work in their trade or profession, and are not required to spend half their time in unlearning what they have been theoretically taught at school. Many persons think that there can be no real technical education unless the sciences in the programme of instruction can be constantly tested in the laboratory or the workshop. Quite a number of our schools are approximating to this connection, such as we have seen in the Free Institute at Worcester, and the industrial department of the Washington University at St. Louis. It will be largely due to examples of this kind that the proper methods of technical education will be universally adopted in the United States, for it now seems as if this was the only system from which the best results can be expected.*

There are also several institutions intended for young women only; such as the Cooper Institute of Design in the city of New York, and the School of Design for Women in Philadelphia. It is a gratifying evidence that the supposed unwillingness of man to allow women equal

* As illustrating the progress made in establishing industrial schools, I learn since the text was written that the Commercial Club of Chicago have subscribed \$100,000 for one upon the plan of the St. Louis Training-School; that Cleveland is also taking steps for raising money for the same purpose; and at Terre Haute \$500,000 have been donated for a similar institution in that town by a private citizen. Manual training is gradually making its way into the State University of Georgia, and Minnesota has placed industrial schools and colleges upon the same footing as respects public support.

In a short time after the training-school has been in general operation, we shall have intelligence and fineness of work which those who have been brought up under the present slipshod method of learning a trade never dreamed of.

educational advantages exists only in tradition ; since the first of these schools was founded by the generosity of Peter Cooper, and the other has been aided through all its difficulties by the liberality of private citizens, and the devoted labors of T. W. Braidwood, the principal of the school and its chief instructor. The object of both is the same : "The systematic training of young women in the practice of art, and in the knowledge of its scientific principles, with a view of qualifying them to impart to others a careful art-education, and to develop its application to the common uses of life, and its relations to the requirements of trade and manufactures."

In the two hundred and twenty-seven institutions variously denominated schools, seminaries, and colleges reported by the Commissioner of Education in 1880 for the higher instruction of women, there is the greatest diversity of means, methods, and resources. Not a few of them provide for college courses of study, but it is impossible to learn to what extent they have recognized the importance of industrial education beyond the fact that music, drawing, art, and popular science are placed in their true rank among the studies to be pursued in all of them.

Good sense and equity require that every desirable facility should be afforded to complete the education of woman according to her prospects in the future, and such as will form her judgment, correct her ideas, and provide her with some skill to fill the occupations to which she is destined. Give her the appropriate instruction, and it will be for her to do the rest. Special schools for the practical education of woman are founded upon inevitable qualities in her will, disposition, and bodily conformation. These constitute a rule of Nature against which human

laws will not prevail; and it is becoming clear that methods and routines ought to be determined by what is best adapted to her condition and wants. For thousands of years she has moved in a limited circle—at first as a drudge, and afterward in domestic life and dependent circumstances. These schools give her a chance; they are like the opening of a new world to young women all over the land, who have to earn their living. They afford them an opportunity of obtaining an education suitable to their circumstances and the times in which they live. It is very fine to speak of home as the only appropriate sphere of the sex; and all will agree that their highest and divinest gifts are displayed when they are the center of a domestic household made harmonious by their wisdom, discretion, and love. There is no sight more beautiful. But nothing will make home more delightful than when its chief ornament has received the advantages of a practical education. Every lady should be taught something useful. It will enable the wife to make the home more attractive. She will be more intelligent, a better companion, and more loved as a mother or as a friend. Her dormant faculties will be drawn out and cultivated, making her stronger for good; and, when the storms of life come, she can brave its dangers, and struggle successfully with its disasters. There is scarcely a sadder sight than the condition of a woman who has been taught only in the fashionable methods of the day, when misfortune has swept away her accustomed means of ease and luxury. Her delicate fingers which have been used only for the display of rings, and her soft white hands can not, in nine cases out of ten, be used for practical purposes. She can select no pursuit, for she knows none. And while Nature calls for work of

infinitely varied character, suitable for the support of all her offspring, this poor woman knows no kind of useful labor.

Besides these, there are multitudes of young women who have to earn a living before getting married, and many more who never get married at all. They do not wish to spend their lives in domestic service, and they refuse to be a burden upon relatives who can ill afford them a support. Now, if the proper course is taken to render them competent, there is almost an infinite number of employments which are suitable for their sex, and upon which they can successfully enter. Indeed, they can almost choose their own pursuit, even to learning a trade. Many prefer to study the arts, some take to science, and others turn to teaching. Not a few of the employments that have been considered masculine are simple and easily acquired, and offer attractions to woman's industry and taste. It is admitted that she has exhibited skill, and patience, and sublime fortitude in family concerns and trials, and any man would be foolish who would not repose confidence in her judgment, clear-sightedness, economy, and business ability in matters appertaining to domestic life. Why, then, may she not exhibit the same qualities in wider fields of usefulness? In pecuniary transactions she can be trusted beyond man. Why, then, should she not have a place in the counting-room and the banking-house? We know that many women have very great business capacity. Why, then, may they not be employed in many branches of trade and commerce? A woman is not expected to perform much out-door labor, but her skill in agriculture is undeniable. She perceives quickly and acts from intuition. She understands easily the nature of

plants, but having no scope she expends her care upon the flowers of the garden, the greenhouse, or the orchard. She is a natural horticulturist and cultivator. Fruit-trees, shrubs and parterres, foliage and verdant lawns, and all the graceful caprice of trees and creeping herbage, present to her appreciative eye the most pleasing and fanciful combinations. She knows, as if by instinct, how to care for growing animals and fowls, and how herbs should be gathered, and fruits ripened and packed and marketed.

And then, again, the whole field of decorative art is open to her taste and genius. Her capacity to occupy it is intimated by her love of ornament, her appreciation of graceful forms, of charming contrasts, of beautiful frescoes and paintings, and of elegant furniture and draperies. The refined state of the decorative arts is conspicuous in the elaborate splendor lavished upon the dwellings of the rich and refined residents in our towns and cities. The principles of design upon which they depend can be acquired by the exercise of ordinary care and diligence; and if women were equally willing to carry on this work, they are as competent as men, and perhaps could excel them in these beautiful productions.

The same may be said of the study of architecture. The act of acquiring a knowledge of its elementary principles involves endowments with which woman is finely gifted. She draws and designs with ease and elegance. Eminently perceptive and poetical, she could interpret her ideas into domestic buildings, and imbue them with a kind of life, and make their walls and proportions speak of her imaginative and romantic feelings. Our edifices would receive a more pleasing combination than is produced by the reasoning faculty, which is alone exercised

by man in his building designs. She would feel the best thing to be done in the number and arrangement of apartments, for who but a woman can know a woman's wants? Yet she has been completely ignored in building the house, and hence we behold in almost every dwelling clumsy proportions and styles more or less vulgar and false. Indeed, the finest structures are often the most destitute of any sense of comfort. Let woman be trained and practiced in household architecture, and you would see sentiment where there is now a dry detail of brick and stone, and a charming niche or a cozy recess in every empty space; and her appreciation of beautiful forms, of graceful details and picturesque outlines would appear in the mansion where she herself is the cynosure of all within its circle.

Besides these, there are drawing, wood-carving, modeling, ceramic painting, and other branches of art, pottery, the whole field of designing and ornament, working in leather, design, *repoussé*, painting, and an indefinite number of employments suited to her capabilities and health, all of which are made possible by these training-schools for women, showing that there is no sex in work except ability and adaptation.

New trades are opened every year to women. The census of 1880 shows that they are employed in a great variety of work; such as the manufacture of artificial feathers and flowers, book-binding, shoe-work, tailoring, dress-making, confectionery-work, twine-making, corset-making, fireworks, canning vegetables and fruits, dressing skins, making hosiery, matches, cigars and cigarettes, model-making, photographers, telegraphers, plumbers, pipe, elastic, and pocket-book makers, shirt-makers, pump and

refrigerator makers. There are also female doctors, preachers, insurance agents, and trained nurses for the sick, type-setters, writers, authors and poets, artists, painters and sculptors, bank presidents, cashiers, and treasurers.* Many women, young and old, are doing good work, and earning good wages, in these various employments. And the better the work the more it pays. No work is so costly as cheap work, and to this end the girls should have an education suited to these new opportunities, and we ought to be sufficiently liberal and enlightened to see that they also get a general industrial training. Says Emily Faithful, in a recent conversation with a gentleman :

My "policy," in short, has been simply this : I started from the proposition that women are human beings, individuals, with individual needs and rights. To supply these needs and maintain these rights the world's work, its remunerative industries, must be open to them as freely as to men. I do not underrate marriage nor domestic life. I think it is the highest and happiest state for any woman, when it is entered into under the proper conditions and relations. But many women have no vocation for domestic life ; many who have the vocation have not the opportunity. To them the industries must be opened, and to how many a woman the ability to be herself a producer increases the opportunity for marriage by increasing her heritage of desirable qualities ! Her ability to earn is

* In his "Easy-Chair" gossip, in "Harper's Magazine" for August, 1883, Mr. Curtis refers to the State of Massachusetts, where it is announced that there are two hundred and eighty-four occupations open to women, and that 251,152 women are earning their own living in these occupations, receiving from \$150 to \$3,000 each every year. This computation does not include amateurs, or mothers and daughters in the household, and, of course, excludes domestic service.

equivalent to a dower—if we look at marriage from a purely prosaic point of view.

The whole subject of industrial education, in its relation to woman, is here suggested, and in a great measure begun. A false standard of social life has not permitted her to engage in any truly useful labor, or even to teach her children in the smallest detail of practical knowledge. This absurdity will soon have a severe gauntlet to run, and something more will be required of our ladies than to play on the piano and make a formal round of calls, while the husband is deeply immersed in his business pursuits. Let no one think that the author is unfriendly to the refinements of polished society, or disposed to underrate the importance of its graces and embellishments. But surely all ought to consent at this time to give quite as much regard to the special training of women in the various departments of useful labor for which she may be fitted, as to any other subject affecting her welfare, and that this is among the questions of the day which require an unbiased and enlightened consideration.

Indeed, many of the questions concerning the liberal education of women have an answer in these noble institutions, and there is now a tendency in public opinion in favor of their admission to every educational advantage enjoyed by the other sex. In England, colleges have been established for girls with college courses of study, identically the same as those pursued in colleges for young men, and the great Universities of Oxford and Cambridge have provided for the university education of women, and the London University makes no distinction in sex in bestowing its degrees. In the United States we find some

of our colleges taking the same course, and in others they are admitted on the same footing to the same studies, and even to the same classes as the boys. We do not stop now to discuss the problem of co-education in superior courses of instruction; that is being worked out as a practical question in several institutions, and I have not the imprudence to engage in that discussion at present. It may be remarked, however, that the general result shows that the dangers predicted from co-education have not been realized, and that the system is still viewed as favorable to both sexes. This is the conclusion reported at the Cornell University, and at the Michigan University, where co-education has existed for several years.

This, however, is not the end of the question. No doubt the girls will compare favorably with the boys, and quite likely excel them, especially where the studies are of a character to exercise the memory. The friends of co-education have our sincere sympathies, but we fear they overlook a very material consideration; and that is, whether the college courses of studies constitute a true and wise system of instruction for girls. It is a profound conviction pervading society at this time, that the greatest ignorance of every useful art or profitable acquirement marks the notorious incompetency of young men who have received a college degree. They have spent the precious period of youth in painful and laborious studies which, in the progress of modern learning, have become obsolete. The connection between any period of civilization and its accompanying methods of education should be as true of this age as of any one that has preceded it. This is an era of utilitarianism, and perhaps this country is very much so. Education should, therefore, be com-

paratively utilitarian. But it is thought by many that we are given over to an excess of utilitarianism and scientific realism, at the expense of refinement and beauty. This exaggerated attention to the useful will not appear to be unfriendly to the ideal when we bear in mind that whenever the arts of necessity have been appreciated, sculpture, painting, design, and ornamentation have flourished most, and something of their beauty has been transferred to the common articles and uses of life. The remedy for industrial realism, remarks a writer in the "*Revue des Deux Mondes*," is to make things beautiful as well as useful, and of scientific realism to teach the true intelligence of things, and their immediate applicability to the purposes of human life. Victor Cousin thinks that the fine arts are too disinterested and sublimated for use. They are only for beauty, and to inspire a sense of the ideal. Fortunately, he limits them to three only—painting, sculpture, and poetry; and these, he thinks, should be entirely emancipated from everything except the unity and grandeur of art. This does not agree with the ideas of classical art, for the Greeks, who were the founders of all art, included music, rhetoric, letters, eloquence, philosophy, and the dance among the Sacred Nine, and made them all co-ordinate with the needs and servitudes of life. They constituted a practical part of Greek education, and entered into almost everything of value or interest in their daily history.

The same exclusiveness has been claimed by Auguste Comte for the influence of science, who says that the progress of analysis has tended constantly to specialties in science, which ends too often in extinguishing the ardor for science which should be cultivated for itself alone.

It would appear, from the reflections of these philosophers, that all attempts to apply fine art or high science would be to invade their proper domain, and to destroy the sense of the ideal; and that to employ them for any useful purpose, under the pretext of imitation or design, would be to degrade the standard of their infinite perfection. On the other hand, such thinkers as Helmholtz, Tyndall, Huxley, and Spencer teach that practice has its sources in the most elevated and fruitful speculations; and we know that the greatest artists have embellished useful articles with the work of their hands. All knowledge is valuable only as it contributes to the elevation and happiness of man, and all art is useful because a necessary requisite to our social advancement. They warm the genius and the heart by their exquisite beauty, and evolve those delicate perceptions which lead to cultivation and refinement. Herbert Spencer has remarked that, without painting, sculpture, music, poetry, and the emotions produced by natural beauty of every kind, life would lose half its charm. So far from useless are the training and gratification of the tastes, that the time will come when they will occupy a much greater share of human life than now.

But to return from this brief digression to the superior instruction for girls. Now, if its object is to prepare them for useful work, and for a life of self-help and self-support, certainly the study of a dead language can not be the best preparation for either. To get out a few lines of Latin verse by aid of a lexicon, or to be able to parse an Athenian apothegm in the original, with a Greek grammar in hand, is a very inadequate return for the years of toil that must be employed in the acquisition. The more the

collegian studies, the less he knows of real things. He can turn his hand to nothing unless it be to teach others in the same blind way, or to crowd his way into professions already full of those unfitted for them, often from this very cause. To be fed as a clerk, or make a living by his wits, is not the end for which one should undergo so much drilling. To compel girls to go through this labyrinth of language, with a modicum of logic and rhetoric, is progress backward, and the reverse of a true reform. Besides, one can study the Greeks without studying Greek. We admit that Greek civilization is imperishable, because it was original and natural. We know that it continues to influence modern society because it seized upon the spirit of humanity once for all. We witness its intimate incorporation in our refinement and habits. Our sculptors study its marble legacies; our scholars honor its philosophy; and many of the precepts of our daily life have come down to us from its wisdom. The political systems which ruled its little divisions, the intellectual characteristics of the people, their social and religious institutions, their history and achievements in arts and letters, have been elaborated again and again by historians, philosophers, and translators in all languages. From these we can learn all that is essential to know. The argument that the classics should be pursued for their power and influence as an intellectual discipline, without regard to any other criterion of their usefulness, has only the prejudices of centuries to support it. The question of education to-day is, not only to discipline the mind, but to prepare men for the active spheres of industrial and scientific pursuits, to augment their efficacy in producing wealth, to exert an influence in checking evil, and pro-

moting good. Few boys, in their after-career, ever apply a Greek or Latin quotation to any practical purpose. To men who intend to become professional scholars classical studies will probably be useful, and certainly will set off their accomplishments with great decorative effect. Let, therefore, ample provision be made for their critical study in our universities. But I respectfully submit that the time has arrived when they should be optional studies only, and should no longer be a condition of admission. But a little more of this in the sequel.

In primary education the lessons are necessarily the same for both, but it seems to be somewhat different when it is a matter of superior education. The question of common studies is a very different one from that of the equality of sexes. Boys and girls are of the same race, they live on the same air, eat the same food, and are subject to the same laws of life and health, and yet a boy is a boy, and a girl is a girl, and I think that women must get over the idea of pursuing a study simply because men choose to do it, or are compelled to do it. While I would exclude woman from no work or study she might prefer, yet there are some in which her peculiar powers and aptitudes fit her to excel, and of which her circumstances in after-life require the constant application. For instance, the great majority of women are destined to become wives and mothers. The arts of domestic life, and the correlated sciences will, therefore, have a bearing, not only upon their whole life, but upon that of their families. Aside from household duties, there are a multitude of questions in domestic hygiene, physiology, and in regard to the dwelling, the diet, the clothing, and their relation to the climate, and the season, and the atmosphere, which will open up a field

of the most splendid and useful information. The education of women, in this general knowledge of practical principles, presents a wide contrast to the mental training of a girl in an ordinary boarding-school. At a meeting of the French Academy, Dr. Dally read a paper, not long since, in which he showed how careless and forced habits of posture produce deformity of the vertebræ of the neck and loins, and finally a curvature of the spine. He adds that this is more usual and prolonged with girls, for they are, generally speaking, required to remain seated for longer periods than boys, and the germ of some distortion is often left for life, and that these ills are more likely to occur at the period of youth, when the bony structure has not acquired the strength to properly support the rapidly-increasing weight of the body.

These remarks are confirmed by observation, and in ninety-nine cases in a hundred the tendency to distortion was formerly given when the girl was under the discipline of a school for "young ladies."

No doubt sounder principles now very generally prevail in our schools. An English traveler in this country writes as follows to a London paper: "Last fall and winter I visited many of the schools and colleges in the United States. I was especially struck with Mount Holyoke College, in Massachusetts. The curriculum of study there is sound and deep, rather than extensive, while the household work is performed by the girls. I never saw a brighter or healthier-looking set of young women in any school or college anywhere."

A great change is observable. It is becoming clear in the light of common sense, that a knowledge of the laws of health and of the science of domestic life are equally

invaluable to woman as a mother and a wife. Women must do much for their own sex. They know better than man its trials, its wants, and aspirations. A fuller education will develop their faculties, and there seems no reason why a college system could not be adapted for their instruction. I do not believe that the industrial education of women will lessen the grace or refinement of their nature, but, on the contrary, it will enable them to enter upon new fields of duty, develop their natural aptitudes, apply their powers to such acquisitions as will be most useful and interesting, and at the same time qualify them to fulfill all the relations arising out of domestic circumstances. (See Appendix.)

CHAPTER VI.

Education for hand and eye—Method of instruction at Athens—Public schools—Improved methods—Main facts in regard to public schools—Optimistic views of the same—Other lessons than those of the school-room—Statement of the same—Our obligations to the public schools—Want of practical education—Manual training a necessary part of—Foreign designers and workmen—Jewelers' Association—Speech at banquet of—Necessity of art-education to American artisan—Mechanic arts passing out of our hands—Rush for clerical employment—An illustration of their dependence—Decorative art—Science applied to necessities—Telegraphy, photography, aniline—Artistic employments, their effect—Education enhanced by manual exercise—Eclectic education—The highest aim—Intellectual culture not alone education—Our physical constitution—Description of—Association of, in elevating the mind—In expressing its ideas in tangible forms—Their intimate co-operation—Equality of education, the true method—Standard of education in Europe—Commensurate education—Duty of the State—Conclusions from, classified—First, second, third, fourth—Technological education—Not for the mass of children—Object of studies—Right of the State—American Institute of Instruction—Use of tools—Reforms in matters of education difficult—Science in the colleges.

HOWEVER much we may differ about the causes or the remedies, it is manifest that this branch of education has been entirely overlooked until quite recently. Intellectual studies, as they are called, have alone been thought worthy of being introduced into our systems of instruction, while eye and hand culture have not only been disregarded, but absolutely looked down upon with a lofty

scorn. No just conception can be had of their immense value to our structure without their co-education with the brain; their joint sphere of action embraces all employments, the sciences, the arts, agriculture, manufactures, and inventions, together with the application of all these to the necessities and enjoyments of society. To their combined influence and intimate co-operation we owe the conveniences of life, and the masterpieces of art. In this view it is impossible to discern under what guise these executive organs of the mind—these twin-sisters of the soul—are not to be considered as having something to do with education. We teach our young men to repeat Greek verses; but it is hardly possible to conceive of a greater contrast in the matter of education than we present to the ancient method of instruction. The youth of Athens were made the recipients of a practical scholarship. They were not required to study two dead languages for the best period of their school-days. The human structure was regarded as a whole, and instructed as a whole. The court of the Areopagus appointed masters to superintend the education of children, and on this they bestowed the most particular attention. Games, gymnastics, and exercises were prescribed for the young men, that their bodies might be expanded and strengthened, and all parts of the frame developed in harmony with the higher faculties of the mind. Hence came their superlative beauty of person, their hardihood, their endurance, and physical health. They were afterward taught by public masters in the rules of art, and this was a material object in the education of all the citizens. They were instructed, from first to last, in the duties of morality and religion, the respect due to parents, a reverence for

old age, and the strictest obedience to the laws. The love of country and the sentiments of patriotism were assiduously inculcated, and a knowledge of the laws was conveyed by the most impressive lessons. Socrates imbued them with wisdom, Plato with philosophy, and Phidias with art.

Now, if it be true that history is philosophy teaching by example, what standard of education do we find at Athens to justify our own? Shall we do nothing but copy the Parthenon in our public edifices, and their tongue in our scientific nomenclature? A painter, who only copies, will never be a true artist, and one who only translates will never be a poet, and one who only imitates will never be a philosopher. A tree grows from the strength of its vitality, the propitiousness of soil, and the accidents of sunshine and rain in the spot where it is planted, and not from the growth and richness of a distant forest. The American boy is only half educated, or educated in one direction, that is, mentally, and scarcely at all in the direction which still makes Greece the silent companion and instructor of mankind. Even intellectual culture, itself, must depend upon the enrichment of the intuitive powers, and not upon imparted ideas; or, in other words, the capacity of deduction should not be sacrificed to verbalism and memory. It is the mission of a practical education not only to impart the elements of knowledge, but to draw forth the faculties, and train them to act intelligently and successfully in all the circumstances of life.

No one who studies the marvelous history of the public-school system of education in the United States, can fail to acknowledge its extraordinary influence upon the

welfare of the people. New England has been referred to as an example. Founded in our early settlements, its progress has been too slow to suit the fervent wishes of our critics. Undoubtedly important changes must be introduced, suited to the changed conditions of the age. But surely we can have no sympathy with the tendency to injure or destroy this vast agency for good, because it continues to do that good under circumstances that were not foreseen, and could not have been anticipated. Any candid observer will admit the process of improvement going on within the last few years. Not only are the pupils trained in the art of drawing, which lies at the foundation of all constructive industry, but they are imbued with the rudiments of popular science and mechanics; and these improvements demonstrate that the necessity of change has been accepted as a part of a valuable system; and a fair way is thus opened for still greater progress in making public education a fitting preparation for useful pursuits afterward. It is better to be a little behind the age than encounter the dangers of mere empiricism, and if some of our home critics declare the common school a great failure, let us remember that the best and greatest in our own land, and the most keensighted and intelligent in Europe, declare that there is no American institution that they so much admire.

It will not be supposed that, in referring to the deficiencies of the public-school system, there is any design to underrate its general effect, but rather that it should be reconstructed in a manner suitable to the times.

Let us state some of the main facts. We expend, say, in round numbers, \$100,000,000 per annum upon the support of public schools. Our school property may be valued

at not less than \$200,000,000. Splendid school-buildings five stories high, with libraries, and all kinds of conveniences and apparatus for literary education, grace and adorn the most beautiful spaces in our cities; and humbler ones are seen in all the rural districts of the North and West; and, notwithstanding this immense outlay, we are obliged to rely upon foreigners in nearly all the industrial arts that depend upon technical information.

Now, if the object of education is to prepare the pupils for useful and successful work, certainly our present system can not be the best preparation for the wide-working world of to-day. Great as this burden is, the American constituents bear it more cheerfully than they do any other public tax, for they thoroughly believe in the general excellence of public instruction; but the need of this kind of knowledge which it has failed to supply would seem to call for a deep and critical inquiry into the competency of our present system of education, with the view of still further extending, in the direction of present wants, the changes and improvements commenced, as we have seen, with great vigor in some quarters. All intemperate haste on this subject is out of place. The fact has attracted men's attention, and, no doubt, when the changes already made shall have had sufficient time to develop into practical results, more important improvements still will be extended where most needed. These schools have not been made: they have grown. They have become what they are through the course of ages, and they are still growing more and more into the active life of the people. Have patience, brother, and we will yet see the ideal school, or at least a near generation of our children will!

It is often said, in reply to suggestions of this kind,

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that we are not to expect everything from the school-master. This expression has become stereotyped. The family and the world are also teachers, and the lines of Goethe express the great truth that life is the school of manhood :

A noble man may to a narrow sphere
Not owe his training. In his country he
And in the world must learn to be at home,
And bear both praise and blame, and by long proof
Of contest and collision nicely know
Himself and others—not in solitude,
Cradling his soul in dreams of fair conceit.
A foe will not, a true friend dare not, spare him ;
And thus in strife of well-tried powers he grows,
Feels what he is, and feels himself a man.

It is also true that the American citizen has other lessons than those imparted in the school-room. His mind is constantly called into exercise by the greatest of all teachers—experience. He has to estimate the advantages and disadvantages arising from the administration of public affairs, and by this mental exercise he acquires much knowledge, and an expansion of ideas. He acts as a voter, a juror, and as an official ; he is called upon to scrutinize the current events and the symptoms of the times ; he keeps a sharp eye upon the markets, and discusses, or hears others discuss, the relations of labor and capital, and watches public movements with more or less attention ; and thus he acquires knowledge on a great variety of topics, and his reflections embrace a wide field of observation. Perhaps there is no country in the world where so many books are sold. Newspapers are everywhere supported, and they dilate upon all branches of science, his-

tory, politics, morals, poetry, art, philosophy, and woman's rights; and, notwithstanding all drawbacks, they perform their part in carrying on the great work of educating the public mind. While the churches are earnestly engaged in building temples, colleges, and schools for instruction in their various tenets, they also support a vast ministry, publish books and pamphlets for distribution, and so diffuse through almost all ranks of society a great amount of secular information, and a salutary influence upon the life and morals of the people. Then there are addresses upon public occasions, and popular lecturers who must keep up with the spirit of the times, and cultivate a cordial sympathy and understanding with the masses. To these means of informing and educating the people might be added public libraries, museums, congressional debates, literary and scientific societies, popular assemblies, and conventions for all conceivable purposes.

Such, in a general way, on the larger scale of practical life, is the education furnished by the intellectual activity of the age. It will be observed that, valuable as all this is, it affords little instruction in the elements of natural science, and almost none at all in the practice or technics of industrial vocations. Its effect is one of general utility, and possesses as little for the physician or the lawyer as it does for the engineer, the artist, or the artisan.

With regard to the public school, the same remark is almost applicable, for the system of education is there directed to acquirements of general utility. Its tendency and design are not only to train the intellect, but also to impart accomplishments which, in the main, are of a utilitarian character, and such as can be turned to some account in the active business of life. The general effect has been

to make the people intelligent, self-reliant, quick, and ready to learn the beneficent features of any useful pursuit in which they engage. It renders them prompt to serve their country in official service, or on the field of battle. Our obligations to the public school are numerous and important; much of the general intelligence which distinguishes the United States is traceable to its teachings; it has given a fair start in life to thousands, and many of the most brilliant and accomplished men in the Union have been recruited from its walls. Its tendency is to elevate the character of our people, and insure the best interests of society. How infinitely important are the detractions of prejudice against these noble results! And yet there are drawbacks and defects that defy disproof; for, while the useful arts of life have exercised the most marked influence upon our position in the scale of civilization, and furnish employments for a very large portion of those who have to earn a living, the necessity of an education commensurate with these wants and relations has not been sufficiently recognized in the programmes and routines of public instruction.

How many, out of the numbers of young men who leave school, and who are gifted with every mental and physical requisite for success, and who are also splendidly disciplined by all the teachings of the public school, can gain assistance from their education in any practical pursuit they intend to follow? To be sure, they get along somehow, and many of them anyhow. The desire of reaching an honorable and useful condition is a stimulus, and in this country the field is broad and open to all, and those who are brave and ambitious come out with success, while others in the stern and aimless struggle have be-

come dispirited and broken-hearted. The difficulty is being seriously considered, and many persons, well qualified to speak on the subject, do not hesitate to recommend the adoption of a course of manual training as a necessary and indispensable part of public education. And, from causes already adverted to, and still further to be discussed, can it be doubted that the improvement would infinitely enhance the value of our school system, until it culminated into a perfection which would leave little to be desired?

It is said that this ought to be done in the workshop or in the manufactory; but, let it be remembered that apprenticeship in mechanical trades has almost disappeared in this country, and well-trained workmen, among native-born Americans, are becoming scarcer every year. Current information states that manufacturers in artistic work are obliged to import foreign designers and workmen in the execution of highly finished productions; thus increasing the competition with our own artisans, and deteriorating the standard of wages for both. At the annual banquet of the Jewelers' Association in the city of New York, in November, 1880, one of the speakers made some remarks so pertinent on this subject, and coming from a practical man, that I can not do better than introduce them here. He said:

"I hardly dare take up any more of your time, but, if you will indulge me a moment longer, I would like to allude to one other subject. I mean the great and growing need we have for the establishment of schools of art and design. The great need that we have all felt in our factories is cultured and artistic taste in our workmen. We need artists as well as workmen. We need men not

only with strong arms and deft fingers, but active and fertile brains as well. We need schools where our young men and boys can be early taught the use of the crayon and the pencil, and where they can learn the art of modeling and designing, and be educated in everything that will tend to make them accomplished workmen and artists. This can only be done by making a commencement in our manufacturing towns and cities, in establishing schools of art and design. There are gentlemen here who employ four or five hundred men, boys, and girls. If, under the auspices of the large and flourishing establishments, and the smaller ones also, something could be done in the way I have imperfectly indicated, I think it would be a good beginning, and a step taken in the right direction. A short, familiar lecture of an evening, not only on designing and modeling, but on the nature of and the working in the precious metals, would greatly add to the interest of the occasion, and the instruction of the class would be a real pleasure and a substantial benefit, and, moreover, would bring together the employer and the employed in pleasant intercourse, and be a real bond of union between them. In some such way a commencement could be made, a class or school be formed which would be but the beginning of that large class and that large school which would one day bring skill and taste to our workmen, refinement and culture to our people, and honor and wealth to the nation."

This is a clear statement of the case, by one who speaks from knowledge, and he shows the absolute necessity of art-education to the American artisan. There is scarcely an artistic trade that is not closed against him. We frequently read in the newspapers that the members of a

trades-union have stopped work for the reason that an apprentice has been employed after the full quota prescribed by their rules has been reached. Under such disadvantages it is difficult to see how our native mechanics pick up their craft. Indeed, the mechanic arts are rapidly passing out of our hands. Our boys and girls are brought up intellectually, and without any taste for or idea of work. They seek other employment. Every year, throughout the land, great multitudes graduate from our schools; and most of them are in a state of perplexity as to how they shall earn a living, and when the world opens its Pandora's box of evils before the young, we can only be comforted by the hope that the confusion will harmonize itself into the best results. They ask themselves, they ask their friends, What shall we do? They have received what would formerly have been considered almost a liberal education, and are not prone to consider the claims of agriculture and the various trades; so they crowd into the large cities and towns, filling all the clerical employments; some of the more resolute, facing the long and toilsome ascent of a regular calling, or the heroic endurance necessary to acquire a profession; while still more of them join the ever-increasing flow into that great section of the community who are ready to accept an empty place on almost any terms. Here is an item of news, going the rounds, which illustrates the condition of thousands: "I am astonished," exclaimed a friend to a clerk, a really well-educated and accomplished person, "that you stand such bully-ragging from that ruffian." "I think of my wife and babies," was the meek rejoinder; "there would be fifty fellows after my place to-morrow." The man had made repeated attempts at suicide, as the strain of

the situation was too hard for him. The writer remarks : "Still they come, by reason of the delusion that the occupation is genteel, and that the labor of a mechanic or farmer, working with his own hands, is low. It will be a good thing for the community when such stuff and nonsense are knocked out of it."

Now, while our native-born workmen are slowly decreasing in number, the artistic trades are multiplying prodigiously in our cities and manufacturing towns, with an ever-augmenting demand for industrial skill, with remunerative employment. The decorative arts, for instance, find the greatest encouragement in the United States, and the extent to which they may be carried is as absolutely boundless as human genius itself. The relish of our countrymen for the best of everything, and their taste for pleasure and display, give occupation to countless arts at home and abroad. Besides, as soon as any branch of science has discovered a principle which can be applied to the necessities or luxuries of life, it receives the utmost attention ; and if it stands the test of practical utility, it immediately receives encouragement in some appropriate department of human industry. The discovery that a magnet could be created by a galvanic current was long thought to be useless ; but it is now developed into the telegraph. So of photography, by which light and electricity are made to exhibit the most beautiful and astonishing phenomena. The materials which produce the brightest and most durable colors are among the least abundant for the manufacture of vegetable dyes, and consequently the most costly ; but, by the application of aniline, the art of dyeing is not only brought to the highest perfection, but also a richness, brilliancy, and durability of coloring quite

equal to that of the Gobelin tapestry of France is secured. And so of hundreds of examples of the same kind, which have incalculably enlarged the range of mechanical and artistic employments. These discoveries not only afford employments: but consider their utility—the car, the steamship, the compass; think of the inappreciable comforts these improvements afford the household of the humblest citizen. We have seen how they promote the agricultural interests, but every trade, calling, and occupation, every profession and interest, all classes in all seasons and at all times—the editor in his gazette, the author in his book, the artist at his easel, and the lawyer in his brief, are every one supplied in various ways by the skill and energy of those who labor in the countless utilities of modern discoveries and arts.

Perhaps the most numerous class attending the public schools are the children of the poor or of those in moderate circumstances, and they are content, and are compelled to be content, with the minimum of mental education. Would not that education be greatly enhanced if it provided some manual exercise which would enable them to enter at once upon their intended trade or business with the greatest advantage? Give them the tool, and a knowledge of its use, together with a general education, and it will be for them to do the rest. They will encounter the inevitable inequalities of human intelligence, and if they are turned from the people's schools without any practical skill to aid them in the unequal combat, they can only count upon one half of their abilities, and can only put forth one half of their strength. An eclectic education would recognize the necessities of their condition.

The disinterested cultivation of the mind attracts the smallest number of those who study, while the great mass leave school as a necessity before finishing its courses. To develop their manual ability in gaining access to an industry or business will insure a durable and salutary means of support to countless thousands when they most need it. An attractive occupation, in which skill is allied to industry, yields not only the means of subsistence, but it stimulates the employed to frugality and diligence; it imparts to them cheerfulness and contentment, and cherishes an elevated spirit of self-respect and independence. This is certainly one of the highest aims, if not the very highest, of a true education. Whatever makes better men and better citizens contributes to the general good and the public prosperity.

It is said that education must be confined to intellectual culture, to the enlargement of the mind by the superimposition of information, and the communication of such rules and precepts as experience has developed and justified; that, in fact, it consists in drawing forth the faculties, and molding them to certain elements of knowledge, which embrace in their generality the whole mental and moral adornment of mankind. The fundamental error in this definition is, that it entirely overlooks our physical constitution. Even in the savage state of human existence they know better, for the parent guides his barbarous progeny to plunder and the chase.

Now, let us see what idea of education is suggested by our physical structure. The Psalmist declares that we are fearfully and wonderfully made. The complexity of our organization attracts the attention and admiration of both art and science. Whether we stand or walk, speak

or hear, look or listen—in our external appearance, alone, we present to the observation a most wonderful phenomenon. And not less so is the adaptation of our senses to the sensible qualities and elements with which we are surrounded. Could we penetrate the surface, and behold the nice articulations which give the hand its extraordinary strength and delicacy of touch—could we look into the attenuated channels which feed the eye with its heavenly light—could a glimpse be afforded us of the almost spiritualized tissues of the lungs, from which flow the melodious accents of human speech—or, could we ascend with the crimson current into the brain, and behold Reason seated upon her throne, and see her hold intercourse through the mysterious labyrinth of the nervous system with the world around us, and taking note of the varied color, relation, and use of everything in matter, time, and space—then, indeed, should we be able to appreciate the association of all these in every human effort, and to acknowledge that each in its degree contributes to elevate and fortify the mind itself. And as the senses are as inlets through which the images of things are carried to the intelligence, so they exert an influence not less important to the transcendent powers of the mind, by executing its ideas, motives, and perfections in the concrete forms of constructive art. Like a master who employs those possessing special skill in his works, so the brain employs all the capacities of hand and eye, of touch and sound, to interpret its designs and thoughts into tangible forms—hence we have a machine, a vase, an article of furniture, a painting, or a ship. The mind conceives, the hand executes; the two agencies bestow their ingenuity upon every object of value. They are distinct, but it would be

difficult, if not impossible, to tell where the idea of the one and the technic skill of the other could be separated. They co-operate intimately and indispensably, and the intellectual enjoyments we derive from the refinements of life are the harmonious results of their enduring labor. To convey the images of external things to the mental faculties, and to work out the thoughts thus created in the mind, is the mission of these organs; and the marvelous precision with which they embody all mental conceptions into forms of usefulness and beauty serve to excite the enthusiasm and admiration of mankind. The eyes and the hands are principally employed in these creations, and it is seen that just as they are perfected in their work can they translate the ideals of the mind and mingle with the intelligence of the spirit. By this means reflection and research are utilized into forms for the practical purposes of life, and the advancement of the race, and art, science, and philosophy embellish our existence. All this implies two kinds of education—lessons in regard to things, to our hands, and to our eyes, and furnishes proof that equality in education belongs to the generic relation of these parts with the mind itself, and is the true method to be pursued at the present time. This is the motto of industrial education—equality of mental and manual training, with due proportions in the order of teaching.

It would be difficult to conjecture to what extent industrial education can be carried. Many general plans have been suggested, and no doubt there have been, and there will continue to be, many doubtful experiments, but we know that schools and workshops have exercised the most marked influence upon the position of the Continental countries of Europe. The standard system of

education to-day in France, Germany, Austria, and Russia, in Norway, Sweden, and Denmark, in Belgium, Holland, and Switzerland, is an intimate incorporation of mental and manual training. Even among the people, the most distinguished by the singular ingenuity and address, if not superiority in their arts of life, this course is the most liberally and energetically sustained. It has recently been constituted a part of the public-school system established in France. The necessity of an education commensurate with the wants and relations of the age is inexorably demanded by human pursuits.

What, then, is the right and duty of the State in relation to this matter? The several States provide schools at the public expense in this country; and primary and secondary instruction is universal and free to all—both sexes and every condition. The right of the State being admitted, the conclusions to be deduced are very simple :

1. That the Government is created for the good of the people, and ought to provide every element of education necessary to their growth as a free and superior race. That the essential thing in education is to apply it to some useful purpose, having for its aim what is for the advantage of society and the development of the individual, and improving all the faculties of man, physical, intellectual, and moral, by studies appropriate to their unfoldment. It ought to develop the talents of the young and make them men and women of the age in which they live, so as to adapt their intelligence to the substantial transactions of life.

2. As the sciences are now connected with every industrial pursuit, the immense value of some knowledge

on these subjects is apparent, for upon them, as guides and instruments, must largely depend the future industry and happiness of the people. The application of the exact sciences to the processes of industry is a matter of the deepest interest to the inventor, the artisan, and the manufacturer. Education ought to be adapted to this state of society in order to prepare men and women for the active spheres of their future work. The time has, therefore, come when preparatory studies should be placed in the programmes of public instruction, especially to teach the natural laws which affect the different trades, together with exercise in hand-work, and the use of tools in general practice, in order to fit the young to master the special industry they intend to pursue.

3. Whether the learning of trades is a proper part of public education is a problem which must be finally determined by the utilitarian struggle our lot in this country demands. The prejudices against it are relaxing, and we may be sure that whatever will bear the test of application, and the observation of a rigorous comparison, will ultimately be established by the gradual process of evolution. Since the decay of apprenticeship, the industrial school will originate in the necessities of our civilization; for it will deal with that kind of study which bears most vitally upon the personal welfare of the industrial classes, and is equally necessary to maintain our superiority in the social and material activities of life.

4. Passing from the vexed question of trades in the public schools, the art of drawing ought to be taught in them all, on account of its refining influence, as well as for the reason that it is the basis of all trades that depend upon design, and the students should be systematically

instructed to work out the designs, and in the principles of perspective, and of color, light, and shadow; also to prepare patterns for textile fabrics, ornamental carving in wood, and ornaments for glass, for pottery, for marble, for stone, and for embroidery. They should also acquire the practice of numerous arts which can be easily learned by those who can draw and the rudiments of practical industry, the use of tools, and a knowledge of a variety of substances connected with industrial art. This would afford a great amount of auxiliary knowledge in any industrial career they might enter upon.

The foregoing summary presents some of the points to be discussed in the following chapters. The claims of technological education, and its condition in this country, have already been referred to, and its scope and purpose have been exhibited as of the highest importance to all industrial pursuits alike, especially where workshop practice has been introduced to teach the students the application of scientific theories to industrial purposes. We have also seen that institutions of this kind exist, or may exist, in each of the States by the bounty of Congress. But the great mass of the children can never reach them, and their only opportunity for acquiring any special knowledge preparatory to practical work must be taught them in the common schools. The workshops, which may be characterized as the last hope of our industrious youth, are closed against them, and apprenticeship exists only in name. If there is no industrial art in the ordinary school-lessons, their lot must be hard indeed.

If it be true that studies should be pursued not only for their influence as an intellectual discipline, but also

for their efficacy upon the pursuits and habits of the people, how can this degree of instruction be withheld, especially since it also exerts a powerful influence in producing wealth, in checking evil, and promoting good? The State has clearly a right to look into and direct the particulars of an education which it freely bestows; and it is the interest of the State that there be no illiterate minds, and that every child should be provided with the preparatory information connected with his future calling. The necessity for industrial education of some kind is so evident that the American Institute of Instruction, at its recent session in Saratoga (1882), appointed a committee upon the subject, and John S. Clarke, of Boston, who was secretary of the committee, among other points, reported the following:

4. Collaterally with this training of the senses, and this study of man, there should be proper training in the use of language for the purpose of receiving and expressing thought abstractly; and also proper training of *the hand in the use of tools for the purpose of expressing thought concretely.*

A foot-note expresses the meaning of the last clause to be:

The tools here recommended are such hand and machine tools as are used fundamentally in the manipulations of wood, stone, and metals—the hammer, saw, plane, chisel, gauge, square, file, lathe, planer, milling-machine, etc.

A discussion ensued on the subject of industrial education in the public schools, which was characterized by great diversity of views, and a motion to lay the subject on the table was carried by a vote of sixty in the affirma-

tive to twenty in the negative. There is to be accorded to this body the highest rank among the educators in the United States, and, while the predominating feeling was unfavorable to any definite conclusion without further investigation, it is to be regarded as a sign of progress that such a distinguished body of teachers should earnestly consider the subject, and impart their convictions to others.

In matters of education the empire of habit is singularly powerful, and innovations can only be accomplished by steady and persistent effort. Industrial education is the imperious demand of the times, and yet able and learned men will find themselves in unfriendly relations with the necessary reforms. We can remember how difficult it was to impress the principles of the equality of science with the classics upon our colleges. The cause of science has, however, been substantially gained, and the universities are now vying with each other in offering facilities for scientific studies.

The future is before us, and the cause of education can but be benefited by the agitation.

CHAPTER VII.

The art of drawing—Natural order of studies begins with it—The lesson of things—Effect of, on industrial education—Indispensable in education—Massachusetts and New York—Branch of primary education in—Prejudice against it—Practical use of drawing—Exhibit at Centennial—French commission at—Experience at Taunton—Women's Art School, Cooper Union—Walter Smith's system—Drawing ought to be directed to the industries—Beauty of outline—It is teaching every trade that depends upon design—Involves easy lessons in geometry, botany, architecture, and history—Geometrical drawing first—Ornament—Its almost universal application in the olden time—Then came utility alone—The working artist—Improvement of public taste—Effect upon our industries—Mr. Outis's work—Drawing in France—French styles—Expenditures for teaching it—The reason of her beautiful works—Great Britain—Her expenditure to promote the art of drawing—Drawing as a branch of study in this country—Common schools—The importance of drawing to various industries—Architecture in New York—Importation of workmen for building.

THERE is one study which lies at the basis of all the constructive arts, and which has been made a branch of primary education to the children of the poor as well as of the rich in all the systems of public instruction in Europe. I refer to the study of the art of drawing. Its importance as a branch of industrial education will justify the space devoted to its consideration.

This art was formerly valued only in its relation to the fine arts. But now the useful can no longer exist

apart from the beautiful, and consequently there are few industries in which drawing can be dispensed with. We have already insisted that the notions of things come to the mind through the senses, and, as our knowledge commences with sensible objects, so the natural order of studies commences with their reproduction. It improves both mind and body, for the eyes become accustomed to seize with rapture the lineaments of Nature, and not only the color and outlines, but the properties of objects before us, whether we are walking, or eating, or working. In fact, drawing is the lesson of things which constitute nearly the whole action of human experience.

If the sight of an object pleases a child, what better exercise can he have than to copy it? He learns the relations of real things, not by didactic teaching which he cannot understand, but intuitively. The exercise not only educates the hand and eye, and in a higher degree the judgment also, but it excites his curiosity, and he is led to draw his own conclusions, which stimulates his desire for knowledge. It is following the rational method of beginning at the beginning. This is why drawing should be placed among the early lessons, and should never lose its place at the head of the programmes. When the art of drawing shall be permanently established in all the public schools, the cause of industrial education will be nearly accomplished, and its place marked in the new order of studies.

Massachusetts gave the key-note of industrial education in the United States by introducing teaching in drawing as one of the several branches of instruction in her common schools, an example which New York followed soon afterward. It is now generally recognized as

the only foundation upon which the useful and decorative arts can be successfully sustained, or upon which they can advance to constantly increasing perfection in form and beauty. From being merely an ornamental accomplishment, it is now in fact regarded as an indispensable element in all industrial education ; and an opinion deduced from experience prevails that all progress in the productive arts not only requires but inexorably demands the most comprehensive and accurate knowledge in the designs and models which drawing alone can furnish. A paragraph has been going the rounds of the newspapers denouncing the teaching of drawing in our public schools, as "educational filigree." I am tempted to give a passage, as furnishing a specimen of the criticism to which this study is sometimes subjected. The writer says :

The frantic enthusiasm about drawing which animated school boards and superintendents several years ago is getting cooler and cooler ; in many places the number of drawing-teachers has been reduced, and a pitiful effort is made to train the regular teachers to the work. This enthusiasm, unfortunately, has cost a great deal of money, and the chief practical result has been that a number of stiff drawings were exhibited at the Centennial celebration at Philadelphia. Whatever good in the way of handiwork this study in our schools has accomplished, could have been brought about in a wiser way. The "training of the eye" and "cultivation of the tastes," so much talked about by some of the people who make their living by teaching drawing in these public schools, have, in all truth and sadness, never yet been discerned. To use the language of common sense, this is trash. The training to read with intelligence and appreciative understanding one famous masterpiece of the English language would be

worth in way of cultivation a thousand of these drawing-lessons.

Possibly one pupil in five hundred has some impulse given to his hand in drawing which may make him in after-life a better mechanic. The other four hundred and ninety-nine have meanwhile acquired no deftness which will assist them on the farm, in the counting-room, or in the kitchen. Why should all these be wrongly busied for the sake of one?

Of course, it may be the fact that drawing is not taught properly in some of our public schools. It is not unlikely that it is in many instances badly taught, because it is comparatively a new study, and there are so few that are yet qualified to give instruction. But is it not most unreasonable to argue that it ought not to be taught at all, since it is indisputable that, wherever drawing is taught on intelligent principles, it is the certain means of progress in all the useful arts of life? The question whether the pupils in our public schools should be instructed in drawing might be easily settled if the disputants would calmly consider that the greatest number of the children are to be the workmen of the future, and that the methods of teaching them should be shaped in accordance to their destiny. No one can doubt but that a knowledge of drawing will be an essential aid to every class of handicraftsmen, for it is the absolute friend of every art. Its predominance is visible in every article fabricated by the hands or ingenuity of man.

The mistake of the writer consists in supposing that the duty of the teacher of drawing in an elementary school is to turn out artists. Now, that is just what is not attempted, and what ought not to be expected. The

practical use of drawing to the pupil is, that it enables him not merely to make but to understand a sketch or plan in the line of his trade. He can give a pictorial presentation of a machine, a building, a bronze, or an invention, and he can work from it without instruction or blundering, without waste of time or material, and carry out the design with taste and beauty. Here is a striking illustration furnished by W. W. Waterman, Superintendent of Schools at Taunton, Massachusetts. He writes that—

Since the introduction of drawing as one of the regular studies in the public schools of Taunton, some ten years ago, and the maintenance of an evening drawing-school during the entire season, a very decided improvement has been observed in the qualification of youth who leave the schools to engage in the industries of the city. The superintendents of our machine-shops and other mechanical establishments report that formerly great difficulty was experienced in teaching apprentices to read plans, and to understand the principles involved in their work.

But now those who have been educated in our schools generally read plans quite intelligently, become better artisans, and produce a greatly improved quality of work.

The superintendent of one of the leading locomotive-works says that he finds the services of the young men who enter his establishment from our schools to be worth twenty-five per cent more than formerly. Before the systematic study of drawing became a part of our school course, skilled labor was, from necessity, brought largely from Europe. Now it is supplied mainly from home talent.

Similar testimony is afforded by the experience of Miss Powers, teacher of drawing in the Woman's Art

School, Cooper Union. She declares that in the course of five years she has abundant proof of the practical value of the instruction. That the designing departments of the artistic trades in New York, and even the architects, have her pupils in their employment; and that entire satisfaction has been experienced by all the employers at the work they have done; and that one of them was especially cordial in his appreciation of the details of the class training in the study of ornament, regarding it as unique, and such as many professional draughtsmen stood greatly in need of. Some of the girls are china-painters, some make designs for lace and embroidery, and in some cases actually do the work. Some are carpet-designers, and many are teaching drawing in all parts of the country. If such are the results in the comparatively short time, in a practical point of view, since the introduction of this study into the education of a few only of our schools, we cannot doubt but they will stimulate others by their example, until drawing shall become as indispensable a branch of general education as writing itself.

A noticeable feature in the passage already referred to is the discouraging sneer at the drawings of our schools exhibited at the Centennial celebration at Philadelphia. It is quite popular among some to disparage all attempts at art by our countrymen. In this instance the writer in question has stepped aside to cast a slur upon the specimens of an art which is destined to play so great a part in the industrial history of the United States. The French Educational Commissioners to the Centennial expressed a very high degree of appreciation of the drawings sent by our schools for exhibition. Professor Walter Smith's system of teaching drawing in the public schools

of Massachusetts had been introduced only two years before, and, owing to the superior merits of his mode of instruction, these schools had taken the foremost rank, and soon afterward became the models for all others. Upon this exhibition, the French commissioners remark that the public schools of Massachusetts presented a collective exhibit extremely remarkable, the most complete of all, and the most methodically arranged; and that, such as these works are, they bear witness to the excellence of the method, to the good disposition of the scholars, as well as to the conscientious and intelligent care given to the instruction, with the view of developing the practice of practical elementary drawing. "If we bear in mind," they add, "that these fruits are the results of a few years of trial, we must admit that never before have such remarkable results in so short a time been attained." We know something of the French character; we also know that no other people have given so much attention to the art of drawing for two hundred years; and we know how it has influenced the industry, the refinement, and the power of their nation. It is unnecessary to suspect exaggeration in their encomium. We may receive the admiration of these men with enthusiasm, for it is the impartial record of their supreme refinement and perfected judgment, which we are at liberty to set off against the sample of popular prejudice referred to, but which is fast dying out.

So far as our public schools are concerned, instruction in drawing, under existing circumstances, ought to be directed to the useful aims of life—to teach children as much as will enable them to represent, in free outline, the solid forms of those objects with which, or on which,

they will probably work. In whatever department of industry the turn of mind or necessities of the artisan may lead him to practice, a knowledge of pure form in drawing will be the basis of real excellence and success. Every article may be made beautiful as well as useful, and the chief attribute of this combination is embraced in the correctness of forms; and the utmost pains on the part of the teacher, and assiduity on the part of the pupil, should be exercised, in order to acquire accuracy and beauty of outline. It matters little how elaborately a bronze or a vase may be finished and decorated, for, when the form is ungraceful, all is thrown away. Indeed, fine finish and elaborate ornamentation are worse than thrown away upon an ugly form; for such are the growing demands of taste that articles can only be made beautiful, and therefore salable, if they conform to the simple rules of drawing. This is almost equally true of every pursuit, whether it is that of a carpenter, a machinist, a shoemaker, a designer, or a tinsmith: greater excellence will be acquired when the artisan labors with the eye and hand, skilled and trained in its practice. It is not a matter of learning only an art, but of teaching, in a great measure, every trade that depends upon design. The study requires time and patience to acquire it, notwithstanding that the elements of drawing are extremely simple. A perpendicular, a horizontal, and a curve—these constitute the elements of the art. A school-boy can be taught to translate a Latin verse into English by dint of years of study; but he can be taught with greater ease and in much less time how, by the use of these simple lines, he can translate a solid cube to a flat surface, preserving its appearance to the eye by isometrical repre-

sentations; and by a little ingenuity still further changing it into a rectangle, a desk, or a footstool. Thus, a knowledge of elementary geometry is unconsciously conveyed to the intelligence without any strain upon the youthful memory, and the reflections naturally excited by the experience are very often utilized, if the pupil is bright, into useful forms for the practical purposes of life.

When the lesson requires the pupil to draw a leaf or flower, he goes among the herbs, he takes the flowers in his hands, and becomes familiar with their form, structure, the arrangement of their parts, the midrib, stems, and veins of plants. These attract and fascinate his attention, and afford amusing and easy lessons in botany. When he learns to conventionalize them, he receives further insight into the analysis of plant-life, which enhances his taste for natural science. And in the same unconscious manner he acquires a knowledge, while practising the art of drawing, of arithmetic, architecture, mechanics, engineering, and anatomy, and he has the pleasure of feeling that he learns them almost alone.

When an historical design is placed before him to delineate, he becomes familiar with the facts relating to the character of the nations who, though dead, continue to delight and instruct mankind by the magnificence and splendor of their arts. Thus do these simple lines, unconsciously to the scholar himself, promote his knowledge, facilitate his learning, elevate his sentiments, and qualify him for honest work and material prosperity. Instruction in this study should be specially adapted to the necessities of industrial art. The principles of geometrical design are prominently apparent in all the forms of labor where construction is employed, as well as in

grading cities, planting colonies, in mining, and anatomy. The characteristics of the lines and curves in geometric drawing, and the instruments used in their arrangement and proportion, are essential things, so far as a knowledge of form is considered, and should therefore be carefully practiced in every system of teaching. Perspective groupings and the various forms of projections are topics which may properly be postponed until the principles involved in the geometrical representation of objects on flat surfaces or in solid forms have been successfully mastered.

But corresponding almost in importance with form is the subject of decoration. Owing to the peculiarities of our taste, which require ornament to constitute one of the principal features of art-work, a critical knowledge of its principles is a necessary preparation for every man who intends to work at a trade. Matters of proportion, construction, and outline, exist independently of extrinsic ornamentation ; but all must acknowledge that, when these qualities are associated with decorative effect in the same production, it commands in a much higher degree our admiration, and the eye of the skilled workman who created it or of the connoisseur contemplates it with pride and emotion. The advantage of an acquaintance with the principles of designing ornamental figures, and of skill in the beautiful delineation of the examples in ancient and modern art, will be very manifest, when we consider that they are applied to all sorts of textile fabrics, to all covering surfaces, such as wall-paper, carpets, etc., and to the various productions in wood, metal, mechanics, and architecture. The different styles that have descended from Egyptian, Greek, Roman, and Gothic

art, will be a pleasing and instructive study, carrying the mind back to those great nations who have passed away, and who now only live in the grandeur and durability of their works. The general rules which govern the arrangement and proportion in the lessons of design are simple and can be acquired by every school boy or girl possessing a mediocrity of intelligence; while in original designing there will be ample scope for rich and picturesque combinations when the pupils are gifted with feeling and imagination.

Great excellence in the art of decorative design was attained hundreds of years ago; and the specimens which have survived are extremely valuable, since many of the art-industries which produced them have either deteriorated or been entirely forgotten. In those days the artist was also a worker, and the artisan was frequently a painter, an architect, or a sculptor. Stones and pebbles, furniture and glass, gold and silver, were so beautifully embellished as to compel the admiration of succeeding ages. An interval supervened during which utility alone was considered as proper in useful things; but within the last few years the application of art to industry has been revived, and a display of the beautiful is again united with the useful, and a great improvement is visible in our buildings, our manufactures, and in the multiplication of artistic employments. The laboring artist has reappeared, and his condition is marked by an air of refinement and the general superiority of his surroundings. Many of them receive very large remuneration. Designing is rising into the dignity of a profession, and many branches of ornamental work are held to be suitable occupations for women. Carpets and wall-paper with beautiful pat-

tern designs, colored glass, fresco-painting, bronze-work, pottery, artistic furniture, wood-carving, and the infusion of dye-stuffs, are rapidly spreading among the industrial arts of America. The movement has become so general as to be the fashion. The evidence is abundant that it is also a genuine feeling, and that the public taste is really improving; and it is just to say that the drawing-lessons of the last few years have exercised a great influence upon our industries, and have served to promote the giant strides of our manufactories.

The education of so many children in the true principles of taste is gradually infusing a sense of refinement, and creating not only a class of skilled workers, but is also preparing still greater numbers to appreciate and purchase their productions.

Indeed, the teaching of free-hand drawing to the children of the United States, and of geometrical and perspective drawing to thousands in the more advanced classes as a regular branch of instruction in our public schools, is a subject of equal importance to us as a manufacturing people with that of writing itself.

An English author published a book in 1869 upon the "Void in Modern Education." * The dignity of the subject and the extraordinary merits of the work exact profound consideration. It contains many striking observations concerning the deficiencies in the present systems of education, particularly in regard to the art of drawing, which more than any other study is calculated to awaken the feelings and the sentiments, while at the same time it is incomparably the best means of expressing form, being greatly superior to language for this purpose; and he

* Outia.

urges that more convincing evidence of knowledge can be obtained on all matters conversant with form by means of a few strokes of the pencil than by an hour's verbal examination. He admits that it may be inferior to modeling where solidity is concerned, yet it is greatly superior in point of rapid execution and a facility for exhibiting the relation of parts, which, often underlying one another, can only be shown by the dotted or faint lines of the crayons; and in speaking of the practical uses of drawing he observes that—

It would be idle to follow in detail all those vocations wherein drawing is equally or even more important: as in civil and military engineering, for instance, where it is simply indispensable; in scientific voyages of discovery, where it is equally so; in all branches of natural history, where it is in special demand; in manufacturing establishments, where it is variously employed both in designs for textile fabrics and for patterns of all kinds; in upholstery, cabinet-making, cutlery, and for the various and all but infinite requirements of the silversmith, watch-maker, jeweler, and the maker of musical, astronomical, surgical, and mathematical instruments; not to mention its value to the potter, the turner, the decorator, the mason, the carver, the frame-maker, and almost every manufacturing tradesman.

As far back as the time of Charlemagne, France founded schools for teaching drawing to her children; and, before the period of the Renaissance, schools existed in Paris, Normandy, Burgundy, Breton, and at various points in the south, so that she was better prepared to understand and adopt the new movement, which she soon developed into the most magnificent compositions in decorative art. From the reign of Francis I, different

styles followed each other, distinguished by the names of her kings, who reigned successively until the monarchy was abolished. During each epoch generations of artists were educated, and France became the school to which those of other nations resorted for improvement. As late as the year 1880 the municipal authorities of Paris contributed to their primary schools nearly \$2,000,000 per annum for instruction in drawing alone, in addition to about \$100,000 for the support of art night-classes. And the state gave upward of \$20,000,000 to promote the same study in the state schools, where free instruction is given to all comers.

Although the French styles of ornament and form have been subjected to much criticism, it is undeniable that the French ornamentists became skillful in beautiful figures, in coloring and in innumerable designs on glass and canvas, and on woven textures, in painting, engraving, in locksmith and goldsmith work, in pottery, in cabinet furniture and bronze, in all of which the science of beauty and skill was so clearly revealed that she has been justly regarded as the modern founder of "art-industry." Hence, also, her beautiful pictures, and her wonderful development of art in every branch of manufactures and industry. She not only supplies us with countless articles of luxury and enjoyment, which we do not so well produce, for want of her educated skill, but in nine cases out of ten it will be found that, in many of our home trades and manufactures which depend upon art or finish, her artisans have been imported into this country to fill the leading positions, and her designs and patterns are either taken bodily or slavishly imitated. Her marvelous wealth springs largely from the superiority of her fabrics ;

and the spirit of beauty which adorns them is the natural result of art-education in her workmen.

Great Britain within the last thirty years has included teaching drawing in her public schools, or rather in those which receive assistance from the Government, and in addition there are thousands of evening-classes for the instruction of those who cannot attend in the day-time; and the number of pupils has gone on increasing from year to year, until in 1879 there were no less than 59,500 students in the science and art schools, and 795,000 in the elementary schools, receiving instruction in drawing, at a cost to the state of \$658,600. It will be seen that the amount expended in Great Britain is insignificant in comparison with what is spent in France for the same objects. But it is apparent in both countries, and indeed all over the Continent, that the onward progress of art as applied to industry depends largely upon the interest which government takes in its promotion, and that the cultivation of art and technical education will advance the social well-being of the people at large; and that, the more thoroughly educated they are, the more rapidly they will excel in all that is essential to the general prosperity.

In Massachusetts, New York, and many other places in this country, lessons in drawing are brought within the reach of every child of the community; and evening-classes are also opened in some of the large towns for the instruction of all who may come. Right here in Washington, drawing is taught in the public schools, not as a speciality, but in the regular course of study. Drawings by the pupils have been exhibited for two years annually (1882) for public inspection; and the fact that such exhibitions are visited by thousands of the citizens not only

displays how general is the interest, but inspires the hope that this art with its refining and commanding influence is gradually assuming its true position in the ordinary course of common school education. It is absolutely necessary that all the business and industrial classes should understand this practical art in the utilitarian struggle of this age and country. All the callings and pursuits that are brought into competition with each other stand ready to appropriate every revelation of art or science that can promote their interest. Science is no longer speculative, and art is no longer confined to mere artistic effect. They are applied to all the industries of society: and the competition is so keen that he who knows best how to apply them to the processes of production is sure of success. The inventor, the artificer, the workman, and the manufacturer are all interested in a study that so deeply concerns their several pursuits. Architecture, bridge-making, every species of machinery and internal improvement; every instrument associated with our labor or convenience; our china and earthenware; the fabrics which are so delicate in texture, so brilliant and harmonious in color, and so striking in general elegance of style, as well as the articles in the parlor, the kitchen, the pantry, and indeed all the improvements in modern life serve to illustrate the principles of design, and are manufactured and fashioned from geometrical patterns and outline representations, which were prepared in the first instance by the draughtsman; and, unless these objects had been symmetrically drawn before they were made, they would never have existed, except in clumsy forms, and perhaps so illy constructed that many of them would have been dangerous to the public.

The art of drawing is used in many cases where its employment is little suspected. Look at a lady in full dress, and consider by what rules her bonnet was plaited, her laces were woven, her stockings were knitted, her comb was ornamented, her ribbons were flowered, her buttons were molded, her necklaces and bracelets were fashioned, her shoes and even the rosettes on her instep were executed ; and the answer will be that they were all devised by designs in drawing, and not a single feature of this lovely assemblage was left to chance or accident.

The building of the poor man's cottage is according to plans and specifications. Its boards, beams, roof, and floors are sawed, tongued, and matched to fit each other according to the draughts, as are also the doors and windows of the humble dwelling. The manufacturers of the simplest instruments—like the hoe, the spade, the rake, the pickaxe, the scythe, the sickle, the reaper, chairs, and bedsteads—all have draughting-offices connected with their establishments. The machinist who makes the shears with which the shepherd clips the flock, and the machinery which cards, and spins, and weaves, the fleece into cloth, is dependent upon his practical designs. The mason cuts the stone upon which he bestows such prodigious labor by the same rules. The beautiful work bestowed upon the granite blocks in the Government edifices at Washington, and by which they are made to fit into their places in those magnificent structures like sculptured figures into their niches, although transported hundreds of miles, are prepared by the same means.

We learn from the newspapers that never before were such costly structures in course of erection in New York

(1882). It has been stated that buildings were constructed last year in that city at a cost of nearly \$100,000,000, and that the furnishing and decorations would amount to as much more. Instances are stated of \$60,000 having been expended in decorating a single apartment. The taste of her millionaires is expressed in ornamentation of their dwellings outside as well as inside, and workmen are brought over from Europe to carve the stone traceries and figures on their house-fronts. Every figure must be cut by an imported artisan, and, of course, the delay and expense are enormous. One of the wealthy citizens is erecting three buildings of this description, and the ornamental work has to wait till these artists from Europe are ready to do it. Four other elegant mansions are also mentioned, one of which will have a single imported chimney-piece that cost \$4,800, made of wood—which is not a scarce article in this wooden country—and a foreign sculptor will design the artistic details of the entrances.

It is useless to find fault with affluent gentlemen because they insist upon having the best. They are able and willing to pay for it. Besides, it is natural for wealth and travel to produce refinement, and, where refinement exists, it is more or less the companion of fastidiousness. It is, moreover, far better for them to spend their money in giving employment to others than to give it away. We should also bear in mind that fine specimens of architecture are among the noblest works of human genius, and symbolize the collective art, science, and wisdom of the people. The aboriginal Greek, who lived in a hovel, had no foreknowledge of the Athenian Acropolis; and perhaps nothing gives us a finer idea of that antique grandeur than its monuments. A temple of

Phidias gives us as sensible an image of Greek character as an ode of Pindar. If the buildings which have invited these remarks will present an arrangement and style illustrating the elements of taste as applied to architecture and the particular ideas of modern life and requirements in our dwellings and public edifices, they will serve as models for the opulent, and will stimulate the sentiments and ambition of our architects, builders, mechanics, and decorators, and so hasten the movement now commenced for art-education as applied to the current facts of our condition.

CHAPTER VIII.

The decorative arts depend upon principles of design—Their position between the useful and scientific—Their immense development—Roman and Greek decoration—Pompeii—Its uncovered ornaments—Moorish decoration—Its magnificence and extent—Table-service for the President—Glass-blowers sent to the United States—Immigration—Skilled occupations of immigrants—The economic value of immigrants—Influx of cheap labor—Exclusion of Chinese—William A. Carsey—An American mechanic on the tariff, cheap labor, etc.—Cheap labor from abroad—Trades-unions limiting the number of apprentices—Growth of our productive force, and of our population—Skilled labor enriches our industries—"Sheffield is coming to America"—American steel exhibit—American porcelain—Palissy—Wedgwood—Gladstone's speech—Wedgwood's improvements—His beautiful productions—Palissy—Enameled pottery rediscovered by him—Our work in pottery—Our styles and workers obtained from abroad—Centennial vase—New branch of industry—Every potter should be a draughtsman—Drawing as a study—Colored patterns for cotton and woollen fabrics—The use of machinery in printing—Chemistry in that art—Value of drawing in it—It yields the grand secret of modern industry—Universal practice of drawing in skilled work—Should be taught to all—The beautiful is overlooked—It is a universal element in nature.

It is almost impossible to conceive how many employments accompany a refined condition of the decorative arts. The number of pursuits which they have furnished to skilled labor during recent years have been so great that it is difficult to classify them, or to observe any systematic plan in arranging them; but it is still true that

they all depend upon a knowledge of drawing and the principles of design. The position of these arts is peculiar, for it must be confessed that they are not ranked as purely useful, or as strictly scientific, but rather they divide the ground between these two, and are closely connected with both. These considerations are of growing interest to the intelligent artisan and the far-seeing friend of industrial education, for their development in our day is simply immense. And here a little detail becomes necessary, and the continuity of the argument will occasionally be slightly interrupted by illustrations showing the use of drawing and design in the arts and manufactures, but it will still be drawing, for design is the very soul of art-industry and the perfection of its work.

The character and form of Greek and Roman decoration are illustrated by the rich colorings and beautiful vignettes of Pompeii, that have not lost their luster in all these centuries. Not only mosaics and frescoes embellish the facings of the uncovered dwellings, but the traveler observes bright pictures of birds, and beasts, and fishes, together with hunting-scenes of the liveliest kind, horses in full chase, wild-fowl and game in the range of a perspective of rocks, rivers, woods, and green hills, upon the walls of a dining-room. In other apartments are seen picturesque and striking ornamental work in great variety, elaborate mosaics and paintings representing figures of animals, scenes from every-day life, and the forms of gods and goddesses, rendered still more effective by the freshness of the overhanging skies and clouds. The marble steps and fountains in the court-yards appear very wonderful, even to those most familiar with such objects. The works of their hands testify how well the Pompeiian

artisans could use the coloring substances with which they were acquainted, and elaborate the most beautiful designs as a matter of ordinary skill and taste. Besides these, there are hundreds of objects gathered in the museums upon which art has been employed to ornament them and give a pleasing effect to the eye; perpetuating a representation of the domestic characteristics of the Pompeians, and of the great extent and variety of their industry, their luxury, and their workmanship. Says a recent tourist, "I should like to spend a week at Pompeii every year, if only to watch the uncovering and revel in the new findings." The graceful outlines and mathematical precision show how much care the Pompeian designer bestowed upon his work.

The wealth and splendor of the Moorish cities in Spain would be incredible were not the facts corroborated by historians whose truthfulness has never been questioned. A French author, whose book has been charmingly translated into our own language by an American lady, assures us that the Moorish provinces at the time of Abderrahman were extremely populous; that there existed on the shores of the Guadalquivir twelve thousand villages, and that a traveler could not proceed through the country without encountering some hamlet every quarter of an hour; that there existed in the dominions of that caliph eighty great cities, three hundred of the second order, and an infinite number of smaller towns; that Cordova, the capital of the kingdom, inclosed within its walls two hundred thousand houses and nine hundred public baths.

These vast cities must have been the homes of industry and the asylums of useful and decorative art; and their magnificence must have furnished constant employ-

ment to multitudes of cunning workers. The Koran prohibited any pictorial representation of human beings or animals; and this interdict modified to a great extent the superficial expression of Morisco art, of which a great many beautiful descriptions have been written by Washington Irving. Here were seen in endless variety the diagonal arabesques filled with foliage, and stalks, and flowers. Here also was invented, or at least perfected, the fine stucco-work for use upon walls and divided into panels, or modeled into fanciful shapes, with ornaments cut into the material, or sculptured into bas-reliefs by hand upon the surface. Here, also, were first used the tile-casings for a great variety of ornamental purposes; frette-work much more elaborate than that of the Greeks and the trefoil of the Egyptians, to give increasing richness to their arabesques. The buildings were rendered still more beautiful by marble pavements, and light and graceful columns, richly gilded; and exquisite geometrical designs in brilliant and enduring colors; open filigree-work shining upon arches white with marble, and penciled with inlays that are still admired by artists of every kind. Indeed, when reading Mr. Irving's description, you feel as if you had before you a scene of enchantment.

We have little information what the condition of the skilled workmen was in that country or in Pompeii; but, from the technical and manipulative skill displayed in their effects, it is evident that they were well trained in the theory and practice of design. It is also evident, from the multiplicity and magnificence of their works, that they must have been a very numerous and powerful part of the people; and we are justified in assuming that their

condition corresponded in some degree to the superiority of their education and refinement. The author cannot enter into the particulars of their form and style of ornament. The characteristics of both are familiar to the professional student, and they are here referred to for the purpose of showing that art-industry when founded upon design is unlimited, that its treasures are endless, and that its augmentations to human pursuits will never cease.

But to return to our own condition. An instance of our want of educated workers is strikingly exemplified in the porcelain table-service for the President to be used in the White House. About five or six years ago the attention of the whole country was called to this extraordinary achievement of American art. It was ordered of the Havilands, of New York, and they engaged Mr. Davis, of the same place, to prepare the drawings. The porcelain was nevertheless made at their famous pottery in Limoges, France, and the French china-painters used the drawings after the style in which they are accustomed to do their own work; and all the persons engaged on the job were Frenchmen, except Mr. Davis, who is English by birth. Let us not pretend to criticise this table-service; but the arrangement lately suggested to lock it up is entitled to respect. At all events, it cannot be exclusively claimed as a specimen of American workmanship, which removes much of the responsibility for its *bizarre* appearance.

A case also occurred in the glass-manufacture in the United States within a few years. A difficulty was experienced in obtaining glass-blowers, and steps were taken to obtain workmen from England. One of the results of this was, that about fifty work-people—men of experience in all branches of glass-manufacture—sailed from

Liverpool for this country, induced to come here by the large wages offered by the agents of the American glass-makers.

The deplorable lack of native skill in art-labor is not confined to ornamental work on our buildings, or in the decorative arts in pottery or glass-making; it was nearly universal until quite recently.

This incident affords an opportunity for a brief digression upon the subject of imported skilled labor which is becoming a very suggestive subject to the people of this country, especially those who work. There is nothing in the vast tide of immigration to the United States which attracts a more grateful interest than the large number of skilled workmen it includes. The table showing the number of immigrants, according to their occupations, prepared by Mr. Nimmo, of the Treasury Department, for the fiscal year ending June 30, 1880, makes the following exhibit:

Professional occupations.....	1,772
Skilled occupations.....	49,929
Miscellaneous occupations.....	188,109
Occupations not stated.....	2,194
Without occupation.....	215,252

These figures are well calculated to attract attention. While every vocation and every profession in the United States, however crowded, receives large accessions from this mighty influx, we cannot but express our regret at the disproportion between those who have skilled occupations and those who have none at all. It is significant, if not alarming. Out of a total of 457,257, there were only 49,929 of the former, while of the latter there were

215,252. In other words, those having no occupation are far in excess of the other immigrants, and nearly equal to them all combined. Out of those landing at Castle Garden, 143,182 remained in New York city alone. Whether the social and domestic influences of the American element, and its superiority in energy and experience, will be able to assimilate this enormous accession to its population in a single city, and redeem it from the cosmopolitan character of the new-comers, is a question that must be postponed for results to determine. That year, to be sure, is distinguished by the largest immigration that has ever been witnessed in the whole history of the country; but it is considered quite certain that the number of immigrants for the present year (1882) will greatly exceed it. Nor is it wonderful that the eager eyes of the people in Europe should be turned toward the enchanting temptations of the West; for when they come here willing to engage in honest work, or qualified in the best modes of improving our industry, and developing to a higher degree the arts of manufacture and the facilities of production, we are glad to receive them under the flag of the Great Republic, and to make them co-equals in our prosperity and freedom. Our land is the neutral ground on which men of all creeds and nationalities can meet with safety, and enjoy the advantages of political institutions essentially free. It is the permanent home of the husbandman, the artisan, and the industrious workman. The economic value of this kind of immigration has materially helped to swell our marvelous growth in wealth as well as in population. But it may well be doubted whether the country gains more than it suffers from the sweeping tide of immi-

grants who, we have seen, have no vocation to depend upon for a livelihood. Undoubtedly among these last belong the horde of ignorant and useless bummers who sell their votes and undertake the management of municipal affairs, and whose presence here adds to the difficulties with which our institutions have to contend.

This influx of cheap labor, and of people having no occupation whatever, is assuming the guise of a serious problem, and there is a growing sense of responsibility for its practical consideration. It is of essential consequence, as bearing upon the question of wages; and were it not for the sensitiveness of politicians the whole subject would at no distant day be exposed to the scrutiny of universal suffrage. The exclusion of the Chinese, who had no vote, is yet fresh; but their numbers all told would not exceed the arrivals at Castle Garden in a single month. It would be instructive, for those who were so alarmed at the presence of a few Asiatics, to visit that place for the debarkation of immigrants, and compare its social elements with those of China Town in San Francisco. If he were alarmed before, he cannot be gratified with the spectacle he now sees.

Among the persons who appeared before the Tariff Commission, during its recent session in the city of New York, was an American mechanic by the name of William A. Carsey, who had the courage and independence to express some wholesome truths directly in point. He made a statement in behalf, he said, of that large class of working-men who had a bitter experience of the folly of strikes, and he declared it to be for the interest of all classes that American industries should be protected against all foreign competitive interests, or else the American laborer

must be reduced to the wages and condition of the European laborer; he therefore asked not only for a tariff on all goods and materials that can be produced in this country, but also for the prevention of the importation of cheap labor. He said that those for whom he spoke tried to be practical and just, and asked only for that which was admitted to be necessary to their own protection; that if the country was flooded with cheap goods and cheap labor, the result would be a war of classes, strikes, riots, and armed rebellion; and he suggested that the commissioners should visit Castle Garden and see the classes of people that are being introduced from Europe to take the place of American workmen, and then visit the tenement sections of the city to witness their mode of living.

This statement appeals at once to our reason and sympathies. The immense importation of foreign labor is rapidly reducing the condition of the American workman to that of an alien in his own country, and is gradually achieving the conquest of our national industries. At least, the undeniable tendency is the reduction of wages for all kinds of work in the United States to the standard which prevails in Europe. The American workman, whether native or naturalized—and I put them both on the same footing—cannot sufficiently consider an influence which bears so directly upon his life, his comfort, and upon that of his family and associates. The evil is greatly increased by the conduct of powerful corporations, who find it less expensive to import their hands from across the ocean than to increase the wages of those they have to a fair living standard.

The trades-unions have incurred a serious responsibil-

ity in this relation. They are composed, I dare say, of intelligent and respectable workmen, who sincerely believe that, by limiting the number of apprentices, they are providing a safeguard for their own craft and protection. In this, it seems, they are mistaken; for the demand for skilled labor will be supplied from the surplus in Europe, if it is not furnished by our own people. Within the last ten years such have been the giant strides of our manufactures that they are quite equal to one fourth part of the products of all Europe combined. Our domestic commerce has advanced until it exceeds that of any nation on the globe. Within the same period our population has increased to fifty millions, and we have constructed railroads in various parts of the country sufficient in length to form a circle twice around the earth's surface. Our foreign commerce—albeit in foreign ships—extends to every cranny of man's habitation. The manufacturing power of the country has nearly quadrupled, and all forms of skilled trades have multiplied in the same proportion; and yet the unions, failing to appreciate these mighty transformations, adhere to their suicidal policy, and the workshop from which the American boy is excluded is supplied by the surplus skilled labor of other nations. While this condition continues, there is no other alternative except to have an immigration sufficiently liberal to supply the deficiency.

The value of the skilled workers is undeniable. As a general rule, they come to this country as affording a wider field of employment and greater promise of permanent individual success, and through every stage of our progress we owe much to their instruction in many of the arts of life. We have not only naturalized them

in our citizenship, but we have also naturalized their ingenuity, their workmanship, and much of what belongs to the skilled methods of their industry. We need not hesitate to acknowledge these benefits, for even the Greeks were indebted for the useful and even the most necessary arts to foreign instructors during every period of their transcendent history, and it was only after going through centuries of toil and hard work that Germany, France, and Great Britain have taken their rank among the civilized nations of the earth. Their artisans are lured to this country, where they find a rich reward in reproducing what is valuable in their arts to enrich our industry and promote our prosperity. They receive employment among the builders of New York, the potters of New Jersey, the glass-makers of Pittsburg, the silk-weavers, the carpet-makers, the steel-manufacturers, the jewelers, the gold and silver smiths, the machinists, the iron-founders, the bronze artists, the fresco-painters, the decorators, and indeed in all other industries where artistic workmanship and the art of design are the secrets of success.

We shall undoubtedly continue to be dependent upon skilled labor from Europe until art education at home becomes a reality. Until this want is supplied the introduction of skilled workmen is a subject of special congratulation. It is the addition to our population which leads to the successful establishment of new industries and the improvement of old ones. By such means we are already enabled to enter into competition with the artistic workmanship of Europe in several of its most important industries. As an instance, "Sheffield is coming to America," is the heading of a paragraph which

announces that a well-known business house in that city engaged in the manufacture of steel for the American market, has organized a company for the manufacture of steel here. The workmen are from Sheffield, and the aim of the company will be to produce in this country a steel of as good quality as that made by them in England. This circumstance shows that Sheffield has been driven from one of its best markets by the steel-makers of our own country, and that our steel industry has expanded under the protection afforded by our legislation and by the introduction of skilled labor from abroad; and it was gratifying to observe that our exhibits of steel at the Centennial challenged comparison with any other steel exhibit from any part of the world.

There is perhaps no useful or decorative art which, from its recent commencement, has undergone such rapid improvement as that of American porcelain. Not only what we make, but what we import, is decorated here, with great elegance and beauty of form, so that buyers can not, unless skilled in the trade, distinguish them from the European commodity. The splendor of our commercial industry is enriched by the increase and variety of our productions in this beautiful art. We know how successfully the French, Germans, and British have practiced the manufacture of pottery, and the unprecedented beauty of their porcelain still gives them a very great advantage in the American market.

Two names stand pre-eminent in the historical development of the potter's art—Bernard Palissy, of France, and Josiah Wedgwood, of England. In speaking of the latter, in an address before a literary society in 1878, Mr. Gladstone made the following remarks:

I cannot pass by the name of Wedgwood without a word. Perhaps I am a little given to what is called hero-worship, and Wedgwood is one of the heroes whom I worship. I do not hesitate to say that I consider Wedgwood, taken altogether, to be the most extraordinary man whose name is recorded in the history of the commercial world. Putting together the whole of his qualities and the whole of his performance, Wedgwood completely revolutionized the character of the fabrics made in England in his period. He recalled into existence the spirit of Greek art. Whatever we may say of earthenware and porcelain manufacture prior to Wedgwood's period, it had never risen to the loftiness of the spirit of Greek art. If you compare the famous porcelain of Sèvres—the vases of Sèvres—with the vases of Wedgwood, or the forms of Chelsea and Bow work with the forms of Wedgwood, I do not hesitate to say that, in my opinion, they are greatly inferior. If you run your eye along this line of production of the eighteenth century in England [indicating]—although I am not by any means denying there are very good forms in others—those of Wedgwood stand pre-eminent. Although Wedgwood revived Greek art, although he seems to have shown he was not satisfied with the forms of Sèvres, yet he did not revive classical forms in a servile spirit. Though in all his productions you are reminded of Greek art, they are not mere reproductions. His style is strikingly original; and although, as the lecturer has said, he was most powerfully aided by such men as Bentley, yet I may say what people have justly said of Queen Elizabeth and her ministers, Burleigh and Walsingham, “How came she to have these great ministers?” It was because of her judgment and discrimination, which enabled her to bring them around her. Not only did Wedgwood completely revolutionize the character of the fabrics, but he carried the manufacture of earthenware, which is not porcelain, to by far the highest point which it has ever attained in any country in the world. Before the time of Wedgwood, England was

not particularly distinguished in respect of the potter's art, and down to the eighteenth century, on the whole, we were importers and not exporters of pottery ; we learned from the world rather than supplied the world ; but from the hour Wedgwood came upon the scene all this was altered, and we became great exporters of pottery, and, from St. Petersburg on the one hand to the Mississippi on the other, the name and the productions of Wedgwood became familiar and were everywhere met with. The crowning triumph that he achieved was this—that Continental factories set about the attempted imitation of his works, and the Royal Factory of Sèvres, richly and largely endowed by state funds, not only condescended to endeavor to rival Wedgwood and his works, but directly imitated them. At the same time, it must be admitted that, great as was the power applied in their department of this art at Sèvres, Sèvres wedgwood is not equal to the genuine work of Josiah Wedgwood. Those who love the art of the potter and his works should ever bear in veneration the name of Wedgwood.

Remember that this magnificent encomium is pronounced by a countryman of Watt and Stephenson, who does not fear placing Wedgwood, the potter, alongside of these signal benefactors of the race. It may be said that he originated this industry in England, and that he carried it to a degree of excellence that has never been surpassed. His fabrics are to this day among the most precious and beautiful specimens of the art. His skill, industry, genius, and success have been emulated by others in the same track, who have furnished the cheapest earthenware combined with the most beautiful forms of ancient or modern art, and which for the last sixty years has constituted an important branch of British domestic and foreign commerce.

Wedgwood began his improvement by inventing the materials of the ware. Rejecting the clays then in use, he selected the purest and whitest clays in the country, combining them with chalk-flints, which he ground to powder and mixed with water until they attained the consistency of cream. He afterward evaporated the water by boiling the compound in large cisterns, until a composition was left of the most perfect uniformity throughout, and of a spotless white color. This paste was used either in the purely white condition, or variously colored with blue, brown, or buff; and with this material he produced imitations of the Etruscan vases, and of the various other works of ancient art, such as the world had never before seen, and such as no artist has ever since surpassed. Some of his productions were miracles of art. Not only did he give the world a cheap earthenware, but a recent writer awards him the praise of making the exquisite products of the sculptor's art in all ages familiar to every householder, so that the workmen in English shops and laborers in the field could use as buttons and ornaments gems of the glyptic art of the best ancient artists.

As Wedgwood conferred upon England one of her most extensive industries, so Palissy bestowed upon France the manufacture of enameled pottery. This art had been known in China, no one knows how long, and her china-ware had been introduced to the Western nations by the Dutch, who at that period were the only Europeans having commercial relations with the Celestial Empire. It was also one of the many arts which the Saracens had carried into Europe, and from them undoubtedly came its use in the majolica-ware of Italy. At

the period of Palissy its manufacture was unknown in France. The story is familiar which represents Palissy finding an enameled cup, and being inspired by its beauty to discover the art which had produced it. He entered upon a series of the most extraordinary experiments, in which sound theoretical principles, heroic perseverance, and handicraft skill were finally rewarded by the most brilliant success—a success that has not only contributed to elevate the taste and workmanship of his countrymen, but which has ever since afforded employment to many thousands of workshops, and furnished articles of beauty to persons of cultured taste in every other part of the civilized world.

It will probably be some years before American skill and perseverance can eclipse them all. In the higher productions of the ceramic art we are still deficient, furnishing not much more than one half of the ware consumed in the United States. Our fine work is said to be excellent so far as it goes, though chiefly performed by foreigners. We still import nearly eight millions in the glass and ceramic productions of Europe. Our finest china comes from Staffordsire, and our most artistic enamels from Limoges and Dresden. Except by way of imitation we have produced little or nothing entitled to notice. There is no reason why we should not create a pottery entirely our own, full of originality, and with a general appearance of a distinct American type. We are the only one among the civilized nations that can show no type of our own in this the most ancient and the most indispensable of all the arts. Our manufactories have been in the habit of obtaining their styles and designs from abroad, as if they were floating fragments just come to hand; and it must

be confessed that these are mixed up sometimes with a great deal of critical selection, and re-employed in a manner which deserves the praise of being a striking resemblance to the original. In this way we make Wedgwood-ware, Italian majolica, Dresden and Limoges porcelain. But in this no particular taste is exemplified, except the fidelity of a copyist rather than the genius of design—the ingenuity of transcribing, and not the faculty which creates. We must cease to imitate, and become inventors; or, if we imitate, it ought not to be the designs, but the designing, which is original. We must strike out for ourselves, and make still greater progress in the empire of industrial science, and learn to apply the laws which subordinate the employment of ornament to the objects and general requirements of design. It is by this simple means that others have reached the highest excellence, and we can overtop them all by the greater development of inventive faculties. Perhaps an exception should be made in regard to our exhibit at the Centennial. The “Centennial Vase,” made at the Union Porcelain Works, Greenpoint, Long Island, is described as being exceedingly rich in color and peculiar in ornament. It is decidedly American, the illustrations representing incidents in American history. The paintings are finely executed, and the whole effect is harmonious and attractive. Other specimens were exhibited, possessing great artistic merit. The prevailing ornamentation was of a patriotic nature. This style of decorating goods is to be encouraged, for it nourishes American genius, and invites our manufacturers to make their own designs, and leave off copying foreign ones. “Let them be original, and there is no doubt that their efforts will be crowned with success, and their

names become known everywhere." We freely give the highest prices paid in this generation for beautiful pottery, and no people are so willing to pay for artistic decoration. We have the clays, the silicas, and other ingredients best fitted for the work. Our invention is proverbial, and has been displayed in all the virtues of purely useful art in every exposition where we have exhibited. Why, then, should we remain at the lowest stage, where finish and design are concerned?

The principal centers of this manufacture in the United States are Pittsburg, Cincinnati, Chicago, and Greenpoint, but perhaps the finest pottery is made at Trenton. Here, I believe, machinery was first extensively applied in the history of the art, or at least more extensively than elsewhere. The famous potter's wheel is now a piece of mechanism, and the clay is mixed into a close, fine, even-grained consistency by processes purely mechanical. The heavy work is done by machinery.

The workmen, no doubt, do their work exceedingly well, and many of them have become experts in all that appertains to the difficult and complex character of their trade.

In the spring of 1879 a strike occurred among the potters at Trenton, and a correspondent, in describing the effect upon the business, mentions that new hands were pretty generally employed. His observations are so appropriate to our subject that I venture to transcribe a portion of them. He writes that—

Many of those who are now in Mr. Davis' employ have received instructions in the highest branches of scholarship, some having even passed through a collegiate course, and, as educated men have more reason and quick-

er conception of the way to do things properly, these Americans will make the best workmen. A word here might not be amiss. Why do not more American young men turn their attention to this new branch of industry? There is as good a field open for them in it as there ever was in "going West." Their education fits them to learn it thoroughly, and when they have done this, by the exercise of a little economy while being taught the business, and saving up a small capital, they can start out as manufacturers themselves. The best English potters of to-day have raised themselves from the bench to their present positions. What has been done can be done again. Now, most of the men employed in this line are foreigners; why should not Americans take advantage of this opportunity of learning a good business, and being paid better wages for learning than they can earn by labor in any ordinary vocation?

Mr. Davis is a native of England; he came to the United States some years ago, and commenced the business of which he is now the sole and responsible master.

Without a theoretical knowledge of their trade our workmen are but imitators. Every potter should be a draughtsman, so that he could not only do the work with his own hands, but design it in his imagination. Drawing is but the representation of the object, or the embodiment in concrete form of that which is first created in the mind, and, if understood, the soul of the artist enters into his work. The time will come when no one will be reputed a good workman who cannot design as well as execute. Whoever is trained in a knowledge of the principles of his handicraft may become not merely a workman, but a high artist. The man who can draw and model will show the value of his acquired knowledge by giving elegance of form, grace of outline, and beauty

of detail.

of ornament to whatever he produces ; and every effort will inspire him with motives to higher and better work. As he addresses the public eye with picturesque illustrations of his own taste, new sources of infinite enjoyment will be open to him ; and his serviceable attainment will glide into beautiful visions of his own feelings and enthusiasm upon the various substances which the repertories of nature have spontaneously submitted to human industry.

The value of drawing as a study is also realized as a charming accomplishment, when the pupil can give a fine delineation of a tree, a flower, a statue, or a building, which may have excited his fancy ; while the care he bestows upon a graceful design teaches his mind how to think, enlarges the scope of his imagination, and breathes the sentiment of his peculiar idea into the subject he has chosen for his pencil.

Without attempting to give all the illustrations of this character, let us select one more example which is furnished by the process of applying colored patterns to cotton and woolen fabrics. It was not until about the beginning of the eighteenth century that calico-printing was practiced in modern Europe. The designs were first carved on wooden blocks in relief, and then laboriously printed by hand. These were superseded by copper, upon which the most delicate lines of the designer could be traced, and impressed like an engraving upon the cloth. Then came roller-printing, by which each color was printed on the cloth as it lay stretched on a board, and the colors were laid on one after the other by the labor of men and women, very much, it may be supposed, as the colored lithographs or chromos of the present day. These im-

provements in the machinery, by which so much labor has been saved, have been accompanied by discoveries in the production of brilliant colors, by inventions that engrave automatically the most intricate designs, and by constant appeals to the draughtsman for the most beautiful combinations in pattern-figures to print upon textile fabrics.

The science of chemistry has achieved one of its greatest triumphs in this art, nor has this been the result of chance, but has come from experimental essays and an inductive application of recognized principles of greater or less generality. And while perhaps in no domestic art has machinery so much abridged the process of production, and secured so great a degree of economy in labor and expenditure, it is equally to be admitted that the dyer or calico-printer ought not only to understand the infusion of dye-stuffs and the chemical reaction of colors, but also the harmony of beautiful colors and how to display and contrast them. He ought also to have taste in patterns, and judgment in applying them in the most effective manner to the textile fabrics he is to beautify. This he can discover by the accurate rules of drawing and the general principles of design. A vague impression of beauty, which is not decided by any fixed principle, is generally without any aim, and seldom grasps the probabilities of a design. A class of men have now come who are not only practically educated in this industry, but to whom the lessons of designing have yielded the grand secrets for which modern industry must ever be grateful.

Take notice also how anxious we are to surround our every-day life with what is pleasant and agreeable ; hence the cabinet-maker is equally indebted to the aid of practical designs in drawing, in order to furnish our homes,

and make them comfortable and attractive. By this means he carves his wood, and veneers his mahogany, and puts together the most elaborate as well as the simplest pieces of furniture, and decorates them with beautiful fringes, tassels, and fixtures, until they exhibit every variety of form and color. The jeweler, the engraver, the engineer, the naturalist, and the mathematician, can not hope to meet with much success when ignorant of the rudiments of this art. Beauty of form will give a practical value to the product of every trade. An ugly pattern is salable in no market. If any one desires to know how beauty and form and color of surface are preferred to the same class of articles not so embellished, he can inform himself in the store of any merchant who consults the tastes of his customers, and keeps a sharp lookout for the prevailing demands of trade.

In a word, drawing is the most practical of all arts. It stamps its beautiful lines on every article. Its teaching should not be a specialty any more than writing. The whole community should be equally educated in its principles, for it would imbue the whole people with elevating and refining influences in the highest sense of our nature.

Most of mankind go through life seeing comparatively little of what is so beautiful in the world; and we lose much of the enjoyment and pleasure that ought to charm our vision. To the cultivated eye all nature is ornamental, and beauty is seen everywhere. Even the atoms, that are invisible from their minuteness, are charmingly decorated when revealed under the lens of a microscope, and are capable of conveying intelligence from eye to eye and from mind to mind, when trained to a knowl-

edge of the lines and curves that give beauty to natural objects, and the circles and ellipses which adorn all vital forms. And yet most men go along, as if they were blind, and without the least idea how admirably adapted are all these forms to the purposes and utilities of life. Where the principles of design are fully comprehended, it will be discovered that this universal element of beauty is adapted to the purposes of human culture and improvement, and that, by its proper appreciation, we may embellish our surroundings to any extent we may desire. A boy, who scarcely knows a pencil when he sees it, can drive the plowshare through the rich prairie-soil which responds in a harvest of grain. This is good and useful work. But another boy, who can also raise a crop, and who has had the advantage of an art education, takes a worthless piece of clay and some sand from under his feet, and, mixing them together, gives to the mass a beautiful form, and, placing it in the furnace, burns it in colors that will never lose their freshness or luster, and thus by ingenuity and taste combined produces a vase that brings gold from the rich and applause from all. Ten to one, the outline and details of the design came from his knowledge in drawing.

CHAPTER IX.

Drawing (continued)—The Massachusetts act of 1870—Want of teachers—Normal Art School—Current methods of teaching drawing—Professor Krusi's views—Drawing as an intellectual discipline—It compels observation—Its influence upon the understanding and the imagination—It is an educational study.

Nor more than twelve years ago (1882) there was probably not a competent teacher of industrial drawing in any of our public schools. To-day there are hundreds, and the number is constantly increasing; and it is especially interesting that the regular teachers are now so well trained in the art that they are giving the best instruction. The public schools of Massachusetts have been foremost in this educational movement. In 1870, by an act of her Legislature, drawing was made a required study in all her schools.

The second section of the act is worthy of constant reference. It is as follows: "Any city or town may, and every city and town having more than ten thousand inhabitants shall annually make provision for giving free instruction in industrial and mechanical drawing to persons over fifteen years of age, either in day or evening schools, under the direction of the school committee." The statute was a conception of paramount importance, but how could it be carried into practical operation in

the absence of teachers trained in the art, and without plan or system in its execution? At this day we can scarcely appreciate the perplexities of the task. There were no precedents. The legislative act was regarded in many quarters as empirical quackery. A study which was looked upon as purely technical had to be made popular; and what had never been done before was to be accomplished where competent teachers, text-books, courses of study, and even the implements for instrumental instruction, had all to be created. The want of competent teachers was a serious drawback to success. It was like a ship on board of which all were utterly ignorant of the rules of navigation. In the annual report of the Secretary of the Board of Education for the year 1878 it is stated that—

It had been found to be impractical to maintain the evening industrial drawing classes for mechanics, or to introduce drawing into the public day-schools, and thus give effect to the act of 1870, without the assistance of persons properly trained and qualified to give instruction in the subject. From this cause the evening classes languished, and little progress was made in the public schools. It was therefore suggested to the Board of Education that teachers of industrial drawing must be provided, or the act of 1870 would remain inoperative.

This gave rise to the State Normal Art School, which the Legislature established in 1873, for the sole purpose of preparing teachers of drawing for all the other schools of the State. The same difficulty had been experienced abroad and overcome in the same way. The Normal Art School was placed under the direction of Professor Smith, and has been attended with results that elicited the favor-

able opinion of the foreign commissioners who visited our Centennial Exposition, especially those from France already mentioned. Special teachers in drawing even in the high-schools are no longer employed, and the regular teachers now do the work, and the pupils are learning more and better than under the rule of specialists. In the report on drawing for 1880 the number of teachers in the public schools of Boston is set down at 1,045, and of these 1,040 have attended the classes in the Normal Art School; or, in other words, all but five of the whole number have been prepared by normal instruction to teach industrial drawing in the public schools of the city, including free-hand drawing, drawing in design, from dictation, memory, model, and geometrical. I do not refer to the statistics of the free evening drawing classes for want of the reports on that subject. These are more particularly designed for the instruction of mechanics and workmen; and when we consider that drawing is at the basis of every constructive art, the knowledge to be derived from its principles must be invaluable in the practice of their trade. The study is conquering its way into favor. Art-education stands high in public favor. Except in special localities a great change has taken place, and it is considered as indispensable to the material success of individuals and communities. Its refining influence is permeating society and elevating labor.

Methods of instruction were adopted in New York and other important cities with equally satisfactory results. But not only were teachers in a less advanced state; the books on drawing were so abstract and technical that they could not be introduced into the public schools with any hope of teaching children. With a

view to the practical development of the art in common-school education, a progressive plan of elementary studies is indispensable—one which presents the primary principles of drawing to the comprehension of the youngest pupils. The children are to be initiated into the language of form, which is not picked up as they do their mother tongue. They must be trained to understand in what exact form consists, and by what means it is produced. The plan generally adopted in our public schools is to lead the students forward by easy steps, teaching them first to draw straight and curved lines on their slates, or from cards prepared for their use; then to combine these lines into various geometrical figures, with explanations of the relation in which they stand to each other as parts of triangles, squares, spheres, oblongs, etc. In some of the most successful systems of teaching, the pupils are also furnished with blocks of various shapes, which they arrange into a great variety of solid figures. This not only excites their interest, but, while arranging the parts into unities, the faculties of representation and invention are exercised in a very marked and practical manner. The characteristic features of each form are discriminated—such as that a square has four angles, that the sides are equal, and the opposite ones are parallel; that a triangle is bounded by three lines, that it has three angles, and that a right-angled triangle has one right angle; the opposite side is the hypotenuse, the other sides are called respectively the base and perpendicular. And in like manner they learn the peculiarities of the numerous figures presented in the early lessons, and the technical terms by which they are designated. They also acquire skill in distinguishing the parts from the whole,

and a knowledge of the arrangement by which they constitute a unit. They practice upon the details of an illustration until they can reproduce it upon the blackboard; and they possess this accomplishment by experience and deduction, for they first become familiar with the constituent elements and can then make a representation of the form. It results from this process that the pupil who has looked upon a figure and become acquainted with its various elements can reproduce its likeness with clearness and precision from memory alone. At this point of study the creative powers of the imagination are awakened, and the student begins to put lines into forms of natural objects, or of the ideals that spring up in his own mind, and he invents little designs which perhaps delight nobody so much as himself.

In order to increase the interest in the study, the pupils are encouraged to draw in outline any object that may attract their attention, so that simple forms of any kind composed of straight and curved lines, and exhibiting the feature of geometrical development, are to be used successfully to impress the mind with the lessons.

This is, of course, an extremely meager sketch of what I understand to be the general plan of primary instruction. In the courses and grades which follow, attention is given to the facts which constitute technical drawing, the representation of form as seen by the eye, the conventionalization from leaf and flower, and the application of drawing in design, machine and architectural construction; while the historical styles of ornament command special attention from the teacher as well as the pupil. This includes the formation of the various geometrical figures, the principles of curvilinear drawing,

isometrical drawing, the study of perspective, and of shade and shadow, and so much of mechanical drawing as will impart at least the rudiments of that important art to those who will have practical use for its application. These lessons are graded, and advance from the simplest rudiments to the most complicated forms of construction. The student is furnished with the fullest illustrations and models all through the course. Free-hand and instrumental drawing are employed respectively where they are best adapted to the stage of the work.

It will thus be seen that the present system begins by teaching how to draw straight lines, and advances gradually until the principles and practice of drawing are quite well understood. Each lesson is a new starting-point for something still more advanced, and each grade when mastered is an intellectual conquest which forms a basis for achieving those above. The traditional system of "picture-painting," and drawing "the figure from copies," is abandoned, and in its place the aim is imitation and a logical appreciation of right lines and curves; and, later, the representation of objects and the elements of perspective; and instead of drawing the human figure, the students are required to practice themselves in geometrical and in shaded perspective, in drawing geometrical solids, ornament in relief, and conventional examples from the forms of leaves and decorative flowers. This reform is confirmed by the valued example of all our large cities, in which the subject has, in the course of late years, received the closest attention.

The only serious danger lies in the tendency to give an undue portion of time to the study of ornament or decorative design, and the consequent desire of the pupils to

become artists instead of artisans, and to make pretty pictures instead of drawings. By the present system young men are not instructed in any manual work or in the usefulness of labor. Four hundred appointments of clerks were announced in the Interior Department at Washington, and there were five thousand applications for the places. Let any business man advertise for a clerk, and he will be overwhelmed in a few hours with all sorts of answers. The public has strong grounds of complaint at this result of school instruction. Designers do good work, and no class of men have done more to improve industrial products and increase employments; but when we consider that most of the children in our public schools ought to be destined for the various industrial pursuits, the aim of teaching should be to prepare them for an "industrial career," and to furnish them with such rules of drawing as can be usefully applied by workmen in their different trades. The means of avoiding this tendency are found in the Massachusetts act, which requires the instruction to be "industrial and mechanical drawing." Every exertion should be made to apply the statute for the benefit of industry and the improvement of manufactures. Perhaps it is inexperience which leads the writer to think that, after learning the elementary principles of geometrical drawing and ornament, and the representation of objects according to their appearance, lessons in mechanical drawing could be readily understood and frequently given. Improvement in the art of design improves all the manufactures to which it is applied, and has suggested not only new branches of useful art, but has revived many of those that had been forgotten or fallen into disuse. It is proper, therefore, that

ornament and design should occupy a prominent place in the system. Mechanical drawing depends more upon rules and instruments, affords but little scope for the imagination, and is perhaps less attractive, because it does not appeal to our sense of the beautiful. But we must also remember that the best of workmen will constantly blunder for the want of knowing the simple rules of mechanical drawing. Those who are gifted to become artists, will have in the technical schools of design ample opportunity to acquire a knowledge of the high art-principles to represent the ideals of their imagination. The public school has humbler work to perform. Subordinate to its educational influence, the main stress should be laid upon industrial drawing, and its economic aspect ought to be recognized.

The trades are very few in which a knowledge of mechanical drawing is not useful. The carpenter lays off his work by its rules, and even the plasterer runs his moldings around the arches and elliptical forms of his designs according to its principles; and if the machinist, in working from his drawings, should mistake the measurements in the merest fraction, more or less, it might destroy the machine unless reconstructed; and if it were started it might be torn into pieces with whatever of collateral injuries. A machine-shop can not be found without the instruments used in mechanical drawing; but very few of the young mechanics know how to apply them, unless they have received rudimentary instruction in their school-days; and except the machinist, the bricklayer, the mason, the engineer, and the builder, are somewhat skilled in its practical rules, they run the risk of waste of time and material, and of always remaining at

the bottom of their profession. How else can they determine the correctness of a drawing, or work out its minutiae? In all the mechanic arts it is clear that the work must be planned upon paper in outline and elevation, and the workmen must be able to read it correctly in order to construct and shape the object so that it will literally materialize the image of the draughtsman in all its details. Robert Stephenson could find but little in the drawing formula of his day that precisely enabled him to construct his locomotive, but he arrived at his measures and systems by arduous and original experiments. In this he was aided by other engineers, who were perhaps more skilled in the principles of mechanical drawing, which is an almost indispensable aid to the inventive powers. The iron horse is harnessed to steam, and manufactured by those who think but little of the wonderful tentative processes which first give it form and energy.

I suppose that mechanical perspective, and the various forms of projection, constitute the leading features of mechanical and architectural drawing. Their teaching has been introduced into the public schools of New York and Boston, but I have not seen any report upon the progress made. Its teaching to the children in the more advanced classes, as a regular branch of instruction in the public schools, is of the greatest importance to the numerous industries pursued in our large cities. The subject is also one of universal interest. The ordinary accidents to which we are exposed arise in too many instances from some error in the work of the draughtsman or the machinist. The unexpected fall of buildings, and their bad construction in case of fire, are sometimes attended with horrors that curdle the blood and sweep away precious lives

with the most excruciating deaths. The wheel or axle of the locomotive may be unsound in material or model, and the train in its rapid flight plunged over a viaduct, bruising and maiming its living freight, and sending our best and most beloved ones into the grave without warning or preparation. Boilers explode, machines are shattered, owing to defective work of some kind, and the newspapers publish a daily catalogue of disasters more appalling than the carnage of war. The lesser evils are also considerable. Think of the annoyance and discomfort of ill-constructed furniture, of imperfect and botchy utensils, and of wretched and degrading forms of household conveniences which still remain! Many methods have been devised to protect us against these dangers and troubles. But among the most effective of all remedies will be the brain and hand guided by the skill in mechanical drawing, that is absolutely necessary to the nature of the work to be performed, or the object to be created.

To Professor Krüsi's "Manual for Teachers" we are indebted for many weighty observations on the practical value of drawing, and from it I borrow the following passages:

Besides its importance as an educational process, drawing is of great practical value in most of the vocations in life. It is indispensable to the highest success in most of the mechanical pursuits. The man who can illustrate his ideas with his pencil rises from the lower to the higher walks of his calling. He plans as well as executes, and he falls naturally into his place as leader and director. The carpenter who draws well becomes foreman, and not unfrequently architect. The machinist who draws, in many instances, becomes a successful inventor.

Ability to draw is of great value to the farmer. By its means he plots his ground and divides his fields. By it he plans his house, adapting it to its surroundings and to its uses. By it he is able to describe the peculiar vegetation, the name of which is unknown to him, and the kind of insect which destroys his crop. By it he fashions his utensils and tools, and communicates his thoughts to others in a thousand instances where ordinary language fails.

In the various manufactures, workmen are in constant demand who have some aptitude and skill in designing. In engineering and in architecture, drawing is an integral part of the professional work. Even to those engaged in the learned professions, drawing may be made of use in various kinds of investigation, and in affording amusement for leisure hours.

Indeed, the exceeding importance of the study receives a new impulse, as it is seen that the language of form is essential in all the pursuits of a busy life. The products of industry and the question of education are bound together for the benefit of the rising generation; and the workmen are trained to think, to combine, and to open their eyes to whatever is beautiful in their work. A great change has taken place; and no one can now doubt the capacity of our people for the study of art, either in its application to industry, or to what may be called its æsthetics.

Systems or series of text-books in industrial drawing, upon the progressive plan, have been used in the public schools for several years; and it is gratifying to know that this simple and practical scheme of instruction has effectually contributed to establish this study as a branch of popular education. It is now taught very generally by persons of professional knowledge and practical

experience, who are familiar with the text-books best adapted to the actual needs of the schools; and it is a matter of sincere congratulation that industrial drawing is a recognized study in nearly all the leading cities of the Union.

The study of the art of drawing is also recommended as a means of intellectual discipline. We all acknowledge the powerful influence exerted by the use of language upon mental operations. Says a profound philosopher: * "Man, in fact, only obtains the use of his faculties in obtaining the use of speech; for language is the indispensable means of the development of his natural powers, whether intellectual or moral." Now, drawing is the universal language of form. If speech can be called the mother, drawing is certainly the godmother, of knowledge. The sensible objects which surround us, and the perception of their form, dimensions, and color, constitute our knowledge of the external world. We may attempt to describe them in words, but a drawing satisfies and instructs the mind with a precision and rapidity that belong only to the crayon. The power of thinking and the power of drawing are inseparable. It is impossible to succeed in drawing a figure, unless every line is considered in its relation to the object delineated. The whole structure depends upon a balance of details. It is a work of reflection throughout, and the process can only be carried on by forethought at every point of its evolution. A child in committing a lesson exercises the faculty of memory, but he rises in the scale of thought when he arranges a few lines into forms resembling the object which he sees, and to which words can only give a tran-

* Sir William Hamilton's "Logic," p. 98.

sient expression. In drawing, the mind itself works as well as the hand in elaborating these unmeaning lines into concrete images of vivid and enduring symmetry.

Drawing opens the perceptions of the pupil. He is almost in the obscurity of night, perceiving little and discriminating less in the objects which present themselves. But now his senses are exercised and trained to observation, and it is like light dawning upon the darkness. He not only recognizes whole objects, like houses, trees, and animals, but he discriminates the component parts, he fixes their position and relation to each other. By this means he acquires immediate knowledge in regard to the science of natural objects and also of those created by art. He perceives points of inquiry worthy of attention in everything that flits before the eye. The leaves upon the trees and the blades of grass in the field are regarded with that scrutiny which such an exact study as drawing peculiarly requires. It assists the artisan at his work and the scholar in the highest range of perceptive philosophy.

Its influence upon the understanding is not less salutary. It is a study of the real things in the world around us. Objects which are dim and meaningless to others, are full of methodical arrangement to the student of drawing. He is quick to discern the plan upon which they are organized, and the harmonizing beauty and order in all created things.

By an act of the imagination he invents designs that would be utterly beyond his power, were it not for the forms and rules which drawing furnishes.

A leaf or a flower in the art of drawing can only be produced by the exercise of the faculty of conceiving how lines of different kinds can be combined to represent the

distinguishing parts of these objects, and to show the relation they bear to each other. The stem and the veins in the leaf, the petal and the calyx in the flower, have their peculiar shape and position in forming the whole. The endowment of thought must be exercised so as to combine the lines in the direction best suited to give effect to the different parts of the figure. Whatever the object may be—a bronze or a vase—the pupil is required to recognize distinctions, and to shape his outlines to give them the degree of prominence which will be true and harmonious. This work ought to be a model of exactitude and grace, and minute details are to be scrupulously studied.

In a word, the intelligence of the draughtsman is put in action, and he becomes the author of combinations in forms and designs under the impulse or by the inspiration of his own genius. He is distinguished by his singular ingenuity, address, and superiority in the arts of life with which or upon which he is employed.

It is also educational in the true and strict application of that term. To convey any special proportion of the material of knowledge, is properly called education. Drawing is essentially an operation of the intellect, in which the hand, the eye, and other parts of the physical system co-operate. It molds these faculties to certain elements of knowledge both intellectually and physically. Professor Krüsi, to whom I have already adverted, holds that drawing is of the greatest benefit “intellectually in compelling correct observation, and in inciting thought which depends upon observation.” It is almost incredible that so little was formerly done to instruct our children in a species of knowledge upon which the useful

pursuits of life depend for so many benefits, and which at the same time contributes as much to the material and social improvement of the race as to the most elevated sentiments and conceptions of the artist. And yet the subject had no place in ordinary education, and the practical necessities, to which it is of the highest importance, were totally ignored. It is now very generally recognized as a systematic study in the course of public-school education. We have seen how it draws forth the perceptive powers, quickening the understanding and the imagination, and directing these transcendent endowments of the intellect in a great variety of ways to the needs and well-being of modern life.

With the general remark that all true intellectual culture depends upon the enrichment of the intuitive faculties, I claim for the art of drawing a permanent place in the programmes of public teaching.*

* The report of the Commissioner of Education for 1882-'83 first makes its appearance while this chapter is in press. It contains a statement of the conclusions of the Royal Commissioners (English) on technical instruction in the different countries of Europe and the United States. As we have stated in a subsequent chapter, they made a preliminary report in February, 1883, which referred exclusively to France, and displayed the activity there in all that relates to the instruction of artisans. The final report is now made public. In regard to the particular subject of drawing, they say:

For instruction in drawing, as applied mainly to decorative work in France, and to both constructive and decorative work in Belgium, the opportunities are excellent. The crowded schools of drawing, modeling, carving, and painting, maintained at the expense of the municipalities of Paris, Lyons, Brussels, and other cities—absolutely gratuitous, and open to all comers, well lighted, furnished with the best models, and under the care of teachers full of enthusiasm—stimulate those manufactures and crafts in which the fine arts play a prominent part to a degree which is without parallel in this country (England). Instruction in art applied to industry and decoration is now pursued with energy in South Germany and in several of the northern Italian towns, and the influence of this instruction on

the employment of the people is becoming very conspicuous in those countries. The government schools of applied art in France, under the decree of 1881, of which the Limoges Decorative Arts School is the earliest example, and which, like the above-mentioned schools, are gratuitous, should be mentioned in this connection. . . .

Among the recommendations is the following :

The board recommends, for public elementary schools, that rudimentary drawing be incorporated with writing, as a single elementary subject, and that instruction in elementary drawing be continued throughout the standards (classes); that drawing from casts and models be required as part of the work, and that modeling be encouraged by grants; that a school shall not be deemed to be provided with sufficient and suitable apparatus of elementary instruction unless it have a proper supply of casts and models for drawing; that proficiency in the use of tools for working in wood and iron be paid for as a "specific subject," the work to be done, when practicable, out of school-hours; that the collection of objects, casts, and drawings for school museums be encouraged; that children under fourteen in England, as already in Scotland, be prohibited from working "full time" in factories and workshops; and that, for the rural schools, instruction in agriculture be made obligatory in the upper grades.—*Report of the Commissioner of Education, 1882-'83.*

CHAPTER X.

Technical education of artisans—Art-industry—Industrial school—Apprenticeship—Trades-unions—Restriction in the number of apprentices—No restriction except want of character—Trades to provide technical instruction—University extension in England—American boys—Clerks and artisans—Manual skill and literary education—Duty of parents—Apprentice-schools in Belgium—Truth and knowledge.

HIGHLY, however, as I estimate the importance of instruction in drawing, yet something more is needed in order to meet the necessities of our various industries. Art ideas must be supplemented by practical workmanship, for both must render their assistance in embellishing articles of utility which administer to the physical wants of man, as well as to those which look to beauty only and the artistic tastes which grow out of it. To compete successfully with foreign work, we must have a class of artisans as highly cultivated in workmanship as those we import from over the sea ; and this skill can only be acquired by practice in their respective handicrafts. It is true that with us applied science and mechanical powers have superseded in a great measure the burden of heavy labor ; but the quick eye, the expert hand, and the acute taste can never be dispensed with in the manual processes of the arts and manufactures. To meet this imperative demand for first-class workmen, without submitting to

the exactions and competition of foreign artists, we must educate the constructive ability of our youth during the period of life which is now devoted to study alone. We have developed in a very high degree the arts of manufacture; but we are nearly without any American artisans in the trades connected with design; and are consequently deprived of the acknowledged sharpness and ingenuity of our own countrymen in helping on American industries. This wide and remunerative field of employment is left to be occupied by partly educated and skilled foreigners. We have excellent schools for all sorts of instruction in the essentials of mathematics, history, literature, and philosophy; but we fit nobody with either skill or knowledge in any particular habit of industry. The United States in 1880 contained 189,000 elementary schools, having 9,720,000 pupils. The government expenditure for education in the several States was \$81,719,000. There were in addition 220 normal schools with 26,000 pupils. These figures in regard to expenditure surpass those of England and Wales nearly five times, and those of France nearly four times. In the number of pupils and the expenditure of means we lead the world; and yet in our magnificent system of public instruction we have not class-room for a single student in any branch connected with industry.

There are numerous institutions in France and Germany in which elementary education and industry are taught at the same time; the design being to imbue the pupils with the rules of art and the rudiments of knowledge while training them in some branch of industry, and thus to utilize the former and elevate the latter as much as possible in a practical way. We have also dwelt, in a

former part of this work, upon the advances made by England within the last thirty years, in forming the connection between the principles of art and her industrial pursuits.

Indeed, art-industry is beginning to play an important part in the progress of nations, and is already regarded in all civilized countries as a source of national wealth and power. The establishment of schools for the instruction of those engaged in our trades and manufactures is, therefore, often the subject of examination in the public journals, especially in the trade magazines, and in essays delivered at educational institutes and social-science conventions. The effort, now so general throughout the United States, to introduce instruction in drawing as a branch of public education, can not be misapprehended. The period appears to have arrived when institutions of industrial science and education can no longer be postponed, and when they must be tried in this country on as large a scale as those witnessed abroad. There seems no reason why the institutional system should not be adapted to the tradesman, the artisan, and the manufacturer, as well as to the more pedantic professions in which men are so thoroughly trained. The reform of our taste has commenced by the purifying influence which proceeds from, and which will gradually make its way through, the community from the universal teaching of drawing. An appeal must now be made in behalf of teaching the processes of production as well as the principles which shall guide the work. The use of tools and machinery does not come by intuition, and industrial knowledge ought to include instruction in their use.

The arts and industries of life are hereafter to be

largely carried on by their instrumentality. There is also a universal desire to bestow, even upon goods of the humblest kind, beauty of form and some of the elegancies of art. A great point in trade is, therefore, to make useful work beautiful. Beauty is a salable commodity; and the artisan who can add it to his work enhances its value and brings profit to his trade. A knowledge of how to work and a knowledge of how to render that work attractive are equally necessary; and success can only be attained by a constant and determined effort to combine them in the workshop and the manufactory. The suggestion is becoming familiar that the industrial school should be established as a part of the public-school system, for the practical as well as theoretical education of the children, at least in the rudiments of the various industrial and mechanical pursuits for which they possess a natural talent. We can not regard the present generation of American youth without giving this problem our serious thought. The situation of American boys is critical and alarming. They are not trained, as in former periods, in a knowledge of any mechanical art; and the consequence is, that skilled workmen among our native population are seldom to be met with. The general education (although most excellent in itself) imparted at the public schools disinclines them to seek employment in any of the trades, while the system of apprenticeship, by which a course of instruction (such as it was) was formerly given in some particular trade, has almost ceased to exist. At that period the humble industries were mostly pursued at home or in an adjoining shop. An ordinary street-shop was often the whole establishment, which contained the stock and the work of the humble manufactory. Here the ap-

prentice was taught in the dexterity of his craft, and often became a member of the household of his master. This view is treated as a picturesque reminiscence which will do very well to talk about, but which presents no point of interest to the craftsman of this day. The time of small industries has passed away, and in their place we have immense establishments employing hundreds of workmen ; and instead of human muscle we employ the assistance of applied science and economic machinery. With these improved methods we have rejected the old customs, without adopting anything in their place to supply the ever-increasing demand for mechanical ability. Besides, by the rules of various trades-unions, all beyond a very limited number of boys are prevented from acquiring a knowledge of their respective trades. In the large cities, these societies usually include in their membership the greater part of the employés in the industrial pursuits, and such are their organization and resources that they can often enforce their regulations, or produce serious embarrassment to their employers. Information is to the effect that the number of apprentices allowed will average probably only one boy to every seven workmen ; that, while in some trades more liberal rules prevail, in others the proportion of apprentices is still less. The total inadequacy of this principle to supply the country with skilled workmen is a matter of universal complaint ; and the best friends of the industrial classes must deeply regret that societies which are capable of so many advantages should have adopted the mistaken idea of monopolizing any particular trade, by restricting the number of those who shall learn it. There is apparently some reason in the doctrine that a man who has acquired his skill by years

of labor and study, and who has become an efficient workman by his own aptitude and diligence, should have a perfect right to select and limit those to whom he will give instruction. It is an accomplishment personal to himself as much as the tools of his trade; and why, he asks, should we expect him to impart his knowledge to others any more than to give away his property? If this reasoning applied to property only, any one would be quite ready to admit it; but the knowing how to do a thing well stands on a different title from that of a bale of merchandise. Few mechanics have learned their trade without instruction in the manufactory or workshop, and I dare say they never dreamed that they were infringing upon anything in the exclusive nature of property.

Besides, labor is the only means which the great mass of mankind must rely upon for subsistence. They are born to this destiny; and to deprive them of that which will enable them to labor is to deprive them of their birthright. It not only limits industry, cuts off employments, and diminishes the productive power of society, but exposes men to all the evils which are engendered by want of regular employment. The members of the union societies are undoubtedly respectable, intelligent, and well-meaning men, and do not intend to produce consequences such as we have just been reflecting upon; but we shall presently see the effects of their mistaken policy upon the rising generation of our own youth. The exclusive right to a trade in a particular class is entirely inconsistent with a convenient division of labor, for it interdicts all mechanical industry to the great mass of American children, and interferes with their right to exercise their skill and industry for their own support. And if each trade has

its own association and rules of restriction, then every important branch of human industry is closed against all but the favored few.

Now, we are well aware that mankind are not gifted with the intuitive faculty of effecting the changes of crude substances into useful and desirable articles of consumption. All the mechanic arts have advanced to their present state of perfection by a gradual process of invention and adaptation. The enormous mechanical powers and wonderful machinery now in use have been reached by the trials and experience of many generations. Both science and art, man's application, ingenuity, and necessities, have from the earliest ages united their energies in producing the diversified callings and pursuits of our modern civilization. And now the idea is distinctly presented that these pursuits were not for the general good of the race which had accomplished them, but for the particular occupation of a privileged class. It seems to me that the proposition answers itself and needs no argument.

I have no fault to find with the principle upon which trade societies are generally organized. They have existed during the whole period of industrial history; and, if they would adopt no other tests in selecting apprentices than those having reference to their physical capacity, age, and moral character, I would leave the matter to the discretion of each particular trade, upon condition that there ought to be a practical course of instruction in each shop, and some skilled workmen to whom the apprentice could apply for explanation as a matter of right. Each society should also provide a course of technical instruction for the members as well as the apprentices. Pro-

fessor Fleeming Jenkin, of the Edinburgh University, in a recent discourse delivered before a trades' council in Glasgow, argues the principle of apprenticeship. His impression is that the indenture system is practically dead; and he declares for workshop instruction, for technical training in the society, and that every lad of good character should be eligible; that there should be a classification of jobs and periodical examination of apprentices. I take the following striking passage from an account of the address:

The pay of apprentices should be uniform, while apprentices should be registered, and the record of their registration would be a certificate, not only of character and competency, but it might also be a high honor. He would have competitions between the apprentices in different shops and towns, principally for honorary but also for substantial rewards, and the highest of these he would call traveling scholarships. The final sanction he should like to see applied would be that a lad who had gone through a definite course of that kind with credit should be received into a trades-union on better terms than those who had not received such an education. What he had sketched would be a real technical education that would make a man a good workman.

Trade societies organized upon this plan would serve to raise a high tone of character by requiring a standard of education and moral worth as the only means of admission; and an adequate degree of skill and workmanship would be maintained by regulations made for the benefit of the society and of the community. The scheme might be rendered still more useful to all the members by occasional lectures upon the principles of science appertaining to each particular industry. The plumbing

trade should have a course of scientific instruction on the subject of sanitary engineering; the building trades, on architectural drawing, and the principles governing the strength of materials, the solidity of walls, and the bearing of arches; the dyer or calico-printer, on the leading principles of organic colors and how they become insoluble on textile fabrics; and so on, with all the other vocations, where technical information would improve the knowledge and lead to a higher standard of excellence in workmanship. The technical education of workmen ought to be provided for by themselves, for no other people can do it so well. In each workshop there should be a course of instruction. We have seen that the industrial classes can organize societies possessing intelligence and resources. Why can not they devise a scheme of education? It would cost less and fare better than an unsuccessful strike, and would leave the whole subject of apprenticeship in their own hands. There is no way now existing by which the young artisan can become an efficient workman in the shortest time possible. And the time is near at hand when, if they provide no means of attaining that object, some scheme of education will be put in operation which will. But of this we will speak by-and-by.

Just here let me observe that something approaching the plan here proposed has been tried during some years in England, under the name of the University Extension Scheme, which is fully delineated by a recent writer, who obtained his information at the Bureau of Education :

In 1873 several of the large towns in England petitioned the University of Cambridge to supply them with courses of lectures on the subjects required for the uni-

versity degrees in arts, on condition that the requisite funds should be provided by the local authorities.

In response to this application a syndicate was formed to consider and advise upon the matter. At its recommendation a system was proposed, under the name of the University Extension Scheme, and inaugurated. Classes were formed, and courses of lectures were delivered in 1874-'75 at different towns. The subjects of the lectures were political economy, the constitutional history of England, social history, English literature, logic, astronomy, light, spectrum analysis, geology, and physical geography. The courses were from three to six months in duration.

The number of persons attending was 3,500, of whom 984 were examined, 315 obtained first-class certificates, and 570 second-class. In 1876 thirty towns were visited, the attendance rose to 7,000, and 1,700 students presented themselves for examination. In 1877-'78 courses of lectures were given at twenty-one centers, which were attended by upward of 10,000, out of which 1,088 presented themselves for examination.

An endeavor is made to meet the requirements and circumstances of all classes of society. The courses of lectures which are given in the mornings and afternoons are mainly attended by the wealthier inhabitants of both sexes; at the evening lectures working-men preponderate. A considerable number of elementary school-teachers attend in all the towns.

The amount of the fees paid by the student is settled by the local committees. They range from 1s. 6d. to £1 1s. for the complete course, but they very seldom exceed 10s. In several centers the fees are quite sufficient to pay all the expenses.

This interesting method of popularizing university education goes much further than is required for a manual and technical education by which the apprentice may gradually become an accomplished artisan, and may there-

fore serve the purpose of illustrating what might be attained with less effort by the same class in this country.

We may, then, submit that the question of wages, the hours to constitute a day's labor, the exclusion of children until old enough, the admission of women to the trades, the protection of employes injured when engaged in a common employment, the duty of mutual assistance in periods of distress, and the manual and technical education of younger workmen, present relations about which each trade knows its own requirements; and it is only by organization that they can explain and carry out their views and maintain their interests. But beyond this they have no moral right to set up close corporations for the purpose of preventing other competent persons from the exercise of industry in learning a trade. Besides, if our boys were trained systematically in the mechanic arts, trades would increase and industries multiply by their skill and ingenuity, yielding employment to our own people. But, instead of that, we are obliged to import hundreds of thousands of skilled artisans from abroad, while our American boys are roaming the streets in idleness. Most of them are willing to work, but find nothing to do, and are compelled to engage in any mean and subordinate employment that will afford a precarious support. The question is presented whether our trades are to be given up to foreigners, or taken by our own people. What are the boys to do? We talk much of their fast ways, their vagrant habits, and their fearful tendency to vice, and we scold them, as if they alone were accountable for the badly-ordered condition of their needs. Our failure to provide suitable employment for them often leads to cases of open rebellion against parental restraint, for they will

not generally act upon their own will unless left in idleness. Let us remember that they cannot become carpenters, blacksmiths, silver and gold smiths, watch-makers, masons, or printers, without opportunities of learning these occupations, and we have seen that they are refused admission into the workshop. Our children are generally regarded as apt to prefer anything but work. It does not appear to be so among families where there is any effort at a respectable life. On the contrary, upon attaining the proper age, it will be found that boys are generally anxious to work, and especially to learn some industrial art. But the doors of the remunerative trades are closed upon them, and the cities are gradually filling up with an unskilled populace deprived of the means of physical prosperity. The scriptural injunction, "Train up a child in the way he should go," is ignored as to the boys of the street, who are not trained at all, or only in their natural predispositions of idleness and vice, from which they do not depart in their manhood. The bad boy is apt to make the bad man. He grows up without any promise of usefulness, and will likely develop into the tramp or criminal. Boys who are allowed to spend their time in idleness contract vicious habits, and only in rare instances become honest men. The chances are that they will graduate from the street without respect for either God or man, and their theoretical information, if they have any, will be drawn from reading the pernicious literature of the day, whose corrupting influence is realized in their daily life. Their pride to earn a living and achieve an honorable position is gone, because there is nothing for them to do. Their want of employment is enforced. They are cut off from a life of useful activity, for, when the trades are practically

closed to our boys, there is scarcely any other path left open for a career of industry. They cannot be expected to fit themselves for skilled work, when the workshops will only receive the few to whom that favor is extended by the rules of the societies. They instinctively turn from digging and shoveling—for there are few young men with the supreme energy of the late George Law, who commenced life by carrying a hod—so that there are really no means of employment left to lure our youth from idleness or to excite their enterprise and ambition. To be brought up as errand-boys and messengers, or to hawk newspapers, vend pea-nuts, or even carry the hod, are not fitting employments for American boys. If you doubt their willingness to work, advertise that a boy is wanted in an office or a workshop, and there will be hundreds of applications within the same day; and your heart will ache at the pleading supplications of the mothers and sisters and other relatives, each with a boy for the vacant place. An editor recently inserted such an advertisement in his paper; and he writes that he was overwhelmed with applicants, and that they pleaded only as those struggling with grim poverty can plead, and the struggle with human pride and gaunt want was such as ought to move the stoutest heart to pity. The anxious and inquiring look of the young boys as they simply pleaded for work, the strained attention with which they listened to the reply which was to make them supremely happy or crush their young hopes with heavy disappointment, were most painful to behold.

It is often said that these boys do not attend the public schools. This, however, is far from being true; but they either stray away, from a disinclination to study, or

have learned no useful work by which they can earn a living, and so lapse into idleness and vice. Even among those who go through the regular course of studies we find the same fruitless search for something or anything to do. They flock to the cities, to become shopmen or agents of some kind. They are mostly clever, and can turn their hands to almost anything but honest work. A Philadelphia merchant advertised for a book-keeper, and in a few hours received six hundred and seventy-three applicants, nearly all of whom asked a compensation that would not exceed two thirds of the wages of a skilled artisan ; and upon that they struggle to maintain a shabby-genteel existence. They are well educated as things go, and scorn to work by hand, and, poor as they are, they would rather beg and fawn for any kind of a job to employ the brain, but not the hand ! A good mechanic has seldom occasion to advertise for employment. He thoroughly understands the enjoyment of independence, for his skill is in demand, and he can almost dictate his own terms. He, moreover, belongs to a class that is increasing in numbers, intelligence, influence, and social position ; and which has the advantage of organizing into associations for the management of their own interests and protection. This is infinitely preferable to the shabby-genteel element in society, that is constantly crowding for situations of every description, except those dependent upon hand-work. To such misguided youths I commend the following excellent remarks of James Parton, the well-known writer :

Compare the mechanics in the Novelty Works with the clerks in Stewart's store. The clerks are excellent fellows ; they look well, dress well, understand their business, and are in every respect worthy members of society ;

but our best mechanics have a certain force of manhood, a weight of character, and depth of reflection, rarely seen in those who only buy and sell.

I should be sorry to say anything to disparage our institutions of learning. Nevertheless, I feel confident that an intelligent youth who remains at school until he is sixteen or seventeen, and then apprentices to a good trade, can get a better education out of his shop (with an hour's study of principles in the evening) than it is possible to get in any college in existence—that is to say, a better education for this new and forming country, where, for fifty years at least to come, no man can hope to play a leading part, except in wielding material forces.

I say, then, lads of sixteen, if you would lay a foundation for sure prosperity, begin by learning a trade. If you would escape the perdition of being a fool, learn a trade. If you would do a man's part for your country, begin the work of preparation by learning a trade.

Since the practical extinction of the apprenticeship system, there is no remedy but the industrial school, which will teach the useful in human labor, and where the pupils will cease to look down upon mechanical skill as an inferior or degrading pursuit. The wonderful additions to our knowledge, almost within the memory of our own generation, offer the noblest field for the employment of our young men. We have discovered numberless forms of applied science, and many more are at this moment on the verge of our horizon. Instead of shoveling grain by hand, there is the huge elevator which loads and unloads immense cargoes for all the populous marts of the world; and our railroads, telegraphs, telephones, and electric lights, reveal new realms of discovery. The merely literary education of the public school must be combined with the practice of manual art, for

this union will be invested with new and amazing functions, and the young men will become skilled in what may be necessary to carry forward the economic developments of all our industries. In these pursuits, the greatest triumphs of the world are hereafter to be attained; and any one with ambition and mechanical ability of any sort should not hesitate to select some useful pursuit, for of such will be the inventors and successful men of the future.

If the commercial cities are crowded with young men who have no higher ambition than to obtain a clerkship, how much larger must the number be here in Washington, where the compensation for mere clerical labor is the maximum! They swarm in duplicated thousands, a burden to themselves and a constant trial to their friends. This condition of affairs does not arise because there is nothing to do. In every branch of skilled industry there is an active demand for good workmen. In consequence of the scarcity of competent artisans, much work has to be postponed, so that while the poor boy, who is not permitted to learn a trade, and the well-educated graduate, are going about begging, hat in hand, for a place, mechanical and artistic skill are far above par, and possess the supreme consciousness of knowing that they have produced more than the worth of what they have received. This unnatural condition could not exist if our youth were taught the use of tools; and the avenues of mere clerical labor would not be crowded by jostling thousands who have lived to regret in want and bitterness that they have no trade, and who are now beginning to learn that there is independence in honest work and true manhood in manual industry.

The ambition of parents to have their children rise in the world comes from an affectionate interest in their welfare. They are apt to think that mechanical industry is demeaning. This false idea corrupts the children, and drives untold thousands into all sorts of pursuits where they have little chance of either usefulness or happiness. Children are born with certain aptitudes. This is equally true of the artisan as of the poet, and, if properly trained, they insure success and an honorable career. A child ought to be taught that for which he has a natural bent, and in which he can do the best for himself, and thus insure a permanent habit of industry suited to his abilities.

An appeal is made to all parents to bring their common sense to bear upon this subject, and to discard all false ideas in regard to honest work. Heaven has given you children, and you should bring them up to be useful members of society. Are you aware that the neglect of this solemn duty makes you responsible for their errors, and for the misery and unhappiness they may suffer? When boys are permitted to roam about the streets of a large city, they soon become acquainted with low, vulgar, and vicious habits, and they will be found at the places of public resorts, using profanity and slang, and quite likely making disturbances. They are out late at night, rioting in the company of the abandoned, and improving more and more in the practice of vice, and the art of going to the penitentiary. The parent who permits this is an accomplice in the crime of his son, which might have been prevented by an exercise of parental authority. Hundreds of young men and boys furnish lamentable proofs of this evil tendency. Many respectable parents acknowledge that their boys are wild, but declare that

they cannot help it, when really they have only themselves to blame for the want of power over their children. Youth need correction, because prone to evil, and, above all things, require some steady discipline, either of work or study, or of both at once, to make them mindful of their duty, and to convince them that attention to something useful is far more attractive than revelry, dissipation, and idleness. It is safe to say that the principal cause of the enormous increase of vice and pauperism may be found in the careless and wicked manner in which children are now trained, or rather in the want of any training at all. As soon as a boy reaches ten or fifteen years of age, and is put to no useful pursuit or study, he is very apt to fancy himself a man, and he believes the best proof of his being a man consists in disregarding parental admonitions, in pursuing his own way, and keeping his own company, and he then travels with wonderful rapidity toward the domain of want and perhaps infamy. Hence the streets swarm with idlers and loafers of high and low degree. These facts stare every one in the face, without causing us to reflect that these street Arabs do not make their own tempers and surroundings, but inherit them by their birth and the examples at home. A child was asked what boys were good for, and replied, "To make men of"; so each one of these vagrants is capable of being made a good man. The lucidity of a gem is not apparent until it is polished. It is the same with character. However low in estate it may appear, care and cultivation can raise it above its condition and make it grand and beautiful. We should remember that our offspring inherit not only our lineaments but our moral nature, and that our example may elevate or mod-

ify their life and character. A wealthy merchant recently made a sagacious remark, viz., that he was going to have all his sons learn a trade of some kind, so that they should have something to fall back upon, in case adversity or misfortune ever overtook them in the business he should leave them. So every father who would restrain his son from entering the habitation of vice, who would correct him when correction was salutary, who would insist upon his attention to moral and religious improvement, and who would teach him to be generous and upright, must, in addition to all these, insist that education shall include practical lessons in some useful art or trade. Until this reformation in teaching the young takes place, the poor workman and the poor boy will swell the increasing ranks of poverty and turbulence.

This remedy is suggested, not only upon a theory which seems reasonable in itself, but also upon the distinct ground of experience in nearly every country on the Continent of Europe. The French Imperial Commission, appointed June 22, 1863, to inquire into the character of technical instruction throughout France, speaking of the moral and intellectual effects of the apprentice-schools in Belgium, declare that the pupils in those workshops learn reading, writing, the rudiments of arithmetic, etc., almost as rapidly as those who are obliged to remain in school all day; and that experience has proved that the introduction of literary and moral instruction is effected with the greatest facility in the workshops, and that it produces an excellent effect on the character and morals of the young workmen. At that date fifty-four apprentice-schools had been established in the kingdom, in most of which primary instruction was given to the extent desired,

and the number of workmen they had turned out in a period of twelve years for a single industry, that of weaving, amounted to 13,481—the greater part rescued from want, mendicity, and all the vices they engender. The same report also says that “the official reports published at Bruges, in 1863, show that everywhere instruction and habits of regular employment have produced the most successful results in improving the morals not only of the children, but also of the parents, and that mendicity and vagrancy have almost entirely disappeared from those districts” where the apprentice-schools are established.

All must admit that these observations agree with the experience of every community where the youth are educated and brought up to steady employment. It proceeds upon the theory that they should receive such instruction as would enable them to enter upon some useful pursuit, and at the same time give them an opportunity to acquire a general education, so that they will turn out to be good workmen and intelligent social beings. This is the need of this nation. Industrial education is our notorious want. A thousand things combine to mold the institutions of a people. Commerce, climate, the attraction of novel inventions, the love of imitation, and the vicissitudes of war—all contribute to national character. But the ornamentation of human existence will hereafter evolve the most important additions to human wealth and advancement; and Art-Industry, that waxing giant of the future, is already at the doors of our educational system, knocking for admission, and promising, not only to furnish skill to our labor, but to elevate our taste, and embellish our ordinary existence with its cheerful and refining influence. I know there is a sentimental prejudice which

considers that it mars the high claims and moral influence of truth and knowledge to measure them by their power of administering to some useful purpose. We should love truth for its own sake undoubtedly, but we should also remember that there is no truth worthy of our consideration which will not benefit mankind. Hence it is that in every effort to diffuse popular knowledge or particular instruction, and in every application of science to the useful arts, genius and learning often find their most important and interesting employment. Attainments in knowledge are often supposed by the ignorant to be of no real importance, and are frequently ridiculed as being barren of all practical utility. But nothing could be more mistaken than this. There is no branch of industrial art which does not owe, for the most part, its improved processes to a discovery of the laws of nature; and the most useful inventions and improvements have resulted from scientific research. And so art, industry, virtue, knowledge, beneficence, fidelity to principle—all in their places—contribute to the wealth, permanence, and prosperity of a nation.

CHAPTER XI.

Education of young artisans—Apprenticeship—English legislation—Mr. Jevons's views—Adam Smith's opinion—Practically no apprenticeship in the United States—Technological schools in Europe—Trade-schools in Germany—Established by law—Supported by the state or local authorities—The school at Hamburg—Trade-schools the most interesting—The one at Barmen—Drawing in all the German schools—The school at Chemnitz—Schools at Vienna—Technical education in Switzerland—The great benefits thereof to that country—Opinion of the French minister in that country—The first industrial school founded there by Pestalozzi—These institutions in France—After the Crystal Palace Exposition—A commission appointed—Important changes—Classification of industrial schools by Professor Thompson—Impossible to exemplify them separately—*École municipale d'apprentis*—Account of the same—Visit of British Commission to the same—French industrial schools not national—*École Saint-Nicolas*—School at Roubaix—Government support within two years—The republican government established a national system recently—Schools in Belgium—Those at Ghent, Tournay, Verviers, and the cities—Apprentice-school for weaving—Technical education in Great Britain—Letter of the Chancellor—Views of Mr. McLaren—Report of the British Commission—Questions which arise as to effect in Europe—Is it suitable for the United States?—Universal opinion in its favor—Report of the British Commission—French commission of inspection—School *la Villette*—Corbon, senator, upon the same—Tolain, senator, on apprenticeship-schools—Industrial training the necessity of the age—Good effect on the industrial classes—Opinion on this subject—Views of educators in the United States—Shall it be in the public school?—Different views entertained—Dr. E. E. White—John E. Clarke—The necessity of this instruction admitted.

ANYTHING relating to the subject of industry ought to be treated as worthy of fair and deliberate attention by

the American people. The manner of educating youthful artisans presents a topic of immense interest, and it is impossible for us, conscious of our great industrial power, to neglect much longer proper measures for industrial training which will be both practical and potential. Formerly, by the statute law of England, an apprenticeship of seven years was recognized as the legal mode of entering a trade, but at the beginning of the present century Parliament repealed all legislation upon the subject. In a work entitled "The State in Relation to Labor," Mr. Jevons, a brilliant writer on political economy, complains of the practice of binding youths to long periods of apprenticeship, and notes with much earnestness that it has fallen into desuetude, and discusses the common law still in force, which allows a parent to bind a child to a long term of industrial servitude; and he thinks it to be a question whether it ought not also to be abolished. He confirms his own views by a well-known passage from Adam Smith ("Wealth of Nations," vol. i, p. 110) in which that great author uses the following language:

The institution of long apprenticeship has no tendency to form young people to industry. A journeyman who works by the piece is likely to be industrious, because he derives a benefit from every exertion of his industry. An apprentice is likely to be idle, and almost always is so, because he has no immediate interest to be otherwise. . . . A young man naturally conceives an aversion to labor, when for a long time he receives no benefit from it. . . . A young man would practice with much more diligence and attention, if from the beginning he wrought as a journeyman, being paid in proportion to the little work which he could execute, and paying in his turn for the materials which he might sometimes spoil through

awkwardness and inexperience. His education would in this way be more effectual, and always less tedious and expensive.

No other mode of learning an industry is suggested or prescribed by these authors, unless it be to limit the term to a less number of years, and to pay the apprentice for what work he executes. In the United States it can scarcely be said that there is any mode of acquiring a trade, except that the boys admitted into the shops or factories pick up their knowledge from seeing the manual work of others. There is no one responsible for their instruction; and of technical education there is none at all. Hence we stand beneath every other civilized nation in the productions of art-industry; and yet there is no nation where there is a greater demand for first-class articles. Technical education in our workshops has no existence; and, as this want is not supplied by the trade-societies, it must be provided for outside of them; for this country cannot afford to draw its skilled labor from other countries, and allow its own people to drift upon circumstances as the only available resource of sustenance. The technological schools of Europe are very numerous, especially in France, Germany, Austria, and Switzerland; and they are generally equipped with machinery and workshops for teaching thoroughly and systematically the actual work required in the various trades and the arts connected with them; and their pupils learn to become civil engineers, foremen in commercial and industrial establishments, and skilled in a variety of mechanical operations.

Inferior to these great institutions, lesser schools are found in various parts of Europe to assist in the education of the apprentice.

The *Gewerbe Schulen*, or trade-schools, in Germany are very numerous, and constitute a harmonious branch in the general system of public education. Elementary schools appear to be graded into lower and higher, and attendance is compulsory in the former until the age of fourteen. Other schools are then provided by the state, according to the pursuits which the children are to take in after-life. The *Real Schule* leads to the polytechnic school, and the *Gymnasium* to the university, and the *Gewerbe Schulen*, or trade-schools, are designed for those pupils who intend to follow industry. The children are admitted into the trade-schools from the elementary schools, and are fitted for their respective occupations in the completest manner possible with the conditions of the school; and the best pupils are allowed to pass into the higher institutions, where a technical education is given in all kinds of applied science.

The trade-schools are established by law, and supported by the state, and sometimes also by the local authorities where they are situated. As, for instance, the city of Hamburg, in 1874, voted \$600,000 for a building to accommodate a "General Industrial School, and a School for Building-Mechanics." This was also the case with the schools of Grünberg, Mülheim, Chemnitz, Crefeld, and several other places. There are also schools that receive no aid from the state, and which are established by societies of manufacturers for the improvement of their fabrics. None of these schools are supported by private liberality. The state does all, except where the local municipalities bear a portion of the expense.

Mr. McLaren, during a journey through Germany in 1878, learned many facts concerning its educational sys-

tem, and, after stating how education is divided and classified, remarks that the most interesting of the ordinary German schools are these trade-schools for boys who intend to follow some business where scientific knowledge is necessary or desirable. One of the most complete is at Barmen, in Rhenish Prussia. The curriculum comprises twenty-two studies, and among them are algebra, geometry, higher mathematics, mensuration and land-surveying, building construction, natural philosophy, mechanics, chemistry with work in a laboratory, mineralogy, botany, drawing, writing, and singing. Each scholar chooses those subjects which are likely to be useful to him in after-life, and with such a large variety it is plain that almost every trade must be more or less represented. In all German schools drawing is considered of great importance, both on account of the pleasure it gives, and its refining influence upon the mind, and on account of its great use in all manufacturing trades. At this school there were about 350 day-scholars, and for the benefit of the artisan population whose children have to work during the daytime, there are evening-classes which are largely attended, and for which the fee is about seventy-five cents a half year. The school at Barmen was erected at a cost of £15,000, and the one at Elberfeld, which joins Barmen, at a cost of £20,000. At Chemnitz, the chief manufacturing town of Saxony, a magnificent trade-school has been built, costing £60,000, to accommodate 600 scholars; and connected with it there is a professor whose sole duty it is to travel about and make drawings of new machines of every description, belonging to all industries, which are afterward used by the students of machine-construction and engineering. They have also a museum for

models of machinery ; and, in addition to this, the government sends the professors, free of expense, to England or any other country, where they can see things that will be of use to them in their work. With such a system there is no wonder that Germany possesses a large number both of skilled and scientific workmen and masters, who come to their work with minds thoroughly trained to appropriate and adopt all the improvements which science can suggest.

Mr. McLaren also found in Vienna several such schools, one of which, for eight hundred scholars, cost between £60,000 and £70,000, and he finds it impossible to describe the admirable arrangements and course of instruction at these schools. They are, as in Germany, largely supported by the State and the municipality, for the fees, which are three or four pounds a year, are quite insufficient to pay their expenses. In Vienna, the schools are very well attended at night by workmen and apprentices ; for there is a law which obliges apprentices to attend a night-school during part of their apprenticeship. They learn chemistry, natural philosophy, geometry, drawing, modeling, etc. We see the result of this system in the immense manufacture of beautiful fancy articles of every description which is carried on in that city. Besides these, there are at least eighty schools in Austria for industrial training.

In respect to technical education, Switzerland has perhaps gone as far as any of her neighbors. Elementary instruction is compulsory until the age of twelve, and is carried on, in a most thorough manner, in accordance with the principles inculcated by Pestalozzi ; and which are now so widely imitated in Great Britain and the United States. At the age of twelve the boys can go to the

gymnasium if they wish to follow a literary career, and from there to the university. But, if they wish to have a scientific or commercial education, they can go to the secondary school, then to the industrial, and, at last, to the polytechnic. Of course, the great mass of children can not afford the time for these courses, and for them the state provides a lower sort of technical school where for a year or two they can learn the sciences best suited to the trade they intend to follow.

Perhaps with the exception of Scotland, the intimate dependence of industrial progress upon educational progress has been nowhere more apparent than in this small and sterile country. Says a French minister in Switzerland: "From among these sterile rocks, there is exported every year an amount of products sufficient to pay for all the importations made, and more especially for the two hundred million francs' worth of goods which France alone sells to that people, which in former times cultivated mercenary warfare as its sole branch of industry; and the country produces, besides, so many skillful men that in every commercial city of the world a Swiss colony is found holding the first rank; and in almost every great commercial house may be found intelligent clerks who have come from Basle, Zurich, or Neuchâtel."

It is a pleasing coincidence that the rugged land about which these gracious statements are made was the first to give an example of industrial teaching, for, going as far back as 1775, that distinguished reformer in methods of teaching, Johann Heinrich Pestalozzi, himself a native of Switzerland, founded at Neuhof a model industrial school for poor children, and for a period of five years devoted his energy, his time, and his fortune to teaching

and training fifty boys in practical knowledge of various industries. That was the beginning not only of the numerous industrial schools now in the world, but also of that profound revolution in elementary teaching which substituted the science of things for their symbols.

The importance of these institutions was not practically recognized in France until long after they had been tested in other countries. The first impulse they received was probably owing to the competition growing out of the Crystal Palace Exposition, where Great Britain saw herself behind other nations in the artistic effects of her industry, and when she promptly commenced that energetic career of reform in art-education which soon carried her work to the front rank among her rivals in the subsequent expositions. The leadership of France in the department of industrial art was seriously threatened, and disregarding for the moment the assumed superiority of her artistic traditions, a commission was appointed which was for a long time engaged in ascertaining what had been done among her neighbors for the technical training and industrial education of skilled artisans. They collected a mass of evidence upon the subject, and among other topics made a strong report in favor of apprenticeship-schools. This was followed not only by important changes in her great technical institutions, but several lesser schools sprang up to give instruction in the manual processes of art to her workmen. The most important of these institutions have been classified by a recent writer under three heads, viz. :

1. Schools which profess to give a training sufficient to qualify the pupil to enter a factory forthwith as a skilled workman, or apprenticeship-schools proper.

2. Schools which prepare pupils for subsequent apprenticeship by giving them some manual and technical instruction along with an ordinary schooling, or schools preparatory to apprenticeship.

3. Institutions for giving technical instruction to the apprentices of a regular factory or workshop, or to the apprentices of some particular industry.

All these, however they may differ in form, are industrial schools, and are to be found in the principal cities, especially Paris, Havre, Douai, Chalons, Lyons, Aix, and Besançon, and are meant to train boys to become good workmen in wood, in building, and in metal trades; i. e., carpenters, cabinet-makers, pattern-makers, smiths, fitters, turners, locksmiths, watch-makers, silversmiths, and in weaving the beautiful fabrics of silk. They are principally supported by their respective localities, and in most of them instruction is free.

Those in and near Paris are of every diversity and character, but in all of them systematic training in the handicrafts is deemed an essential part of education; this is, however, accompanied by elementary and technical instruction throughout the whole period of study. Indeed, the number of these schools in France, although of recent origin, is very great; and it would be almost impossible to exemplify them separately, on account of their variety and different forms of organization. I will, however, as a type of many others established in Paris, mention that of the *École Municipale d'Apprentis*. It has often been described. It was founded at the expense of the city, and began its work in 1872. I am tempted to give an account of it, from an address by Professor Thompson, who examined it most carefully in person,

and described it only after having visited it seven several times for that purpose. He says :

The *École d'Apprentis* of Paris, situated in the Boulevard de la Villette, is a school of similar character, but surpasses the Havre school in size, in the extent of its appliances, and in the general superiority of its organization. The results attained by this school are truly striking. No pupil is admitted before thirteen, nor without his certificate of elementary education. The course of instruction lasts three years, about half the day being given to schooling, and half to practical work in one or other of the workshops. The lads who go out at sixteen or seventeen, are able at once to rank as skilled workmen, earning a wage usually only obtained by those who have served a much longer apprenticeship in the shops, and in some cases to earn higher wages than the average skilled workman who is of age. Happily, the promoters of this school have viewed the experiment in a truly scientific spirit, and the exact data which they have kept upon all statistical matters enable a precise estimate to be drawn of the signal success attained by the school. The school was founded in 1873. Of seventy-four apprentices who had gone out up to August, 1877, sixty-nine remained faithful up to the present year in the industry taught them in the school ; and their average rate of payment on leaving had been equivalent to eighteen shillings a week, reckoning fifty-six hours to the week's work ; their average age on leaving being seventeen and a half. Some of these, the young smiths and metal-turners, earn more than this, and receive from twenty up to thirty and even thirty-two shillings a week, as soon as they go out to work. Now, this school is one where there is a graded series of manual exercises, where those exercises are undertaken solely to develop the pupils' skill without reference to their commercial profitableness, where no work may be attempted until the how and why have been explained, nor until the piece of work has been made the subject of a

proper working drawing. It is a school where regular, systematic, technical, and scientific principles are both instilled in class and insisted upon in the workshops. The instruction is not left to uninstructed workmen, but is in the hands of competent teachers, the head of the workshop staff, for example, being himself a former pupil of one of the *Écoles des Arts et Métiers*, and thoroughly imbued with the scientific spirit, while the teacher of physics is an accomplished assistant in the Paris Observatory. The director, M. Müller, is himself animated with the spirit of the institution, and conducts excellent classes in descriptive geometry and other subjects. M. Bocquet, the superintendent of the workshops, gives a course of technological lessons, which, beginning with descriptions of tools and bits of machinery, bolts, nuts, keys, etc., leads up to a complete knowledge of machinery and of machine tools. Drawing, applied physics, applied chemistry, algebra, arithmetic, geometry, and even industrial jurisprudence, form parts of the curriculum of studies. To visit this school and its workshops—and I have visited it seven times, and spent many hours within its precincts—is sufficient to dispel the notion that the rational scientific apprenticeship advocated here, and in my pamphlet on “Apprenticeship Schools,” is an impossible or Utopian idea, incapable of existing anywhere except on paper. The problem is solved; and it is now simply a question of cost how far this solution can be applied. The small collection of studies executed by the pupils of this school, which I am able—thanks to the kind co-operation of Dr. Müller and of M. Bocquet—to exhibit to-night, will give but a faint idea of the works undertaken by the pupils.

This celebrated school was again visited in the early part of the year 1882 by the British Royal Commission, to inquire into the technical education of the industrial classes on the continent, and in their report they say that

the number attending the school has been constantly increasing. In January, 1873, it had only seventeen scholars. On May 1st, in the same year, the number was sixty-four; last year it was two hundred and fifty, of whom one hundred and seven were of the first year, eighty-one of the second, and sixty-two of the third year; and that the boys who were in the school last year in their second and third years were distributed among the two trades which in Paris command the highest wages; and that the boys on leaving school, with very few exceptions, earn wages varying from 2*s.* 6*d.* to 5*s.* 6*d.* per day.

They also refer to the circumstance that the authorities of the city of Paris have deemed the experiment of apprenticeship-teaching in the school of La Villette sufficiently successful to induce them to decide upon the erection of a number of other similar schools in various parts of the metropolis, and that they have voted 80,000 francs for that purpose.

But we will not now anticipate what we intend to say in a subsequent chapter on the subject of this report. The French industrial schools do not, as in Belgium, Austria, and Germany, constitute a part of a national system of education, beginning with elementary instruction, and afterward admitting the pupils at the proper age into the industrial schools, and from thence into the technological seminaries and the universities. On the contrary, they either are supported by the municipalities, like those of Paris and Lyons, or by business firms like MM. Chaix & Cie; or else they are made self-supporting through the fees and board of the pupils, like the *École St. Nicolas*, in the Rue de Vaugirard, conducted by an

educational association under the auspices of the Christian Brothers. The schools of this association, including the branches, contain upward of twenty-four hundred pupils. The school in the Rue de Vaugirard alone has seven hundred and twenty ordinary scholars and two hundred and fifty apprentices, all of whom are boarders. They pay an entrance fee of about ten dollars, and about one hundred dollars per annum for their board and tuition.

The apprentice-boys receive instruction from the Christian Brothers for two hours daily, which comprises not only the ordinary school lessons, but also teaching in drawing, modeling, and other appropriate subjects. The following trades are taught: Book-binding, optical and mathematical instrument making, type-setting, printing, working and chasing in bronze, brass instrument making, gilding, joiners' work, saddle-making, wood-carving, wood-engraving, map-engraving, and engine-fitting. The apprentices appear to be well taught, and find employment readily after they have left the workshops at wages, it is said, varying from five to even as much as eight francs per day.

An instance is given by a recent tourist, who visited the north of France in the summer of 1879, of how a school of this description is built at the public expense. He visited the town of Roubaix, which is very largely engaged in the manufacture of fine worsted goods. Hearing that a weaving-school had been opened there, he went to see it, and found a small but well-furnished school. The town council, which was composed of the chief manufacturers of the place, had built it for the benefit of the trade, and at the expense of the town. There was a day class with a fee of £16 a year, but instruction in the evening was free.

This is probably a fair example of how schools are built, and, although it may not be the best way, it is undoubtedly a good way, in so far as it provides much better schools than could be built by private subscription, and much better than when the whole subject is left, as with us, to those who take no interest in it.

The Government of France long ago founded polytechnic schools, schools of design, and of drawing and architecture, great engineering and military schools, but it was not until within two or three years that she established industrial schools for training the intelligence of its ingenious people. That of Limoges has already been mentioned, and there is the watch-making school at Cluses, to take the place of the municipal school for the same trade at Besançon, which has also been described. To the republican government of France belongs the honor of accomplishing more for the industrial education of its artisans than all the governments that preceded it. It has recently established a national system for the diffusion of education to all classes, and it has displayed its devotion to the interests of labor by decreeing that manual training shall constitute a leading feature in the programmes of instruction.

The relation of education to industry has been nowhere more clearly demonstrated than in the beautiful little kingdom of Belgium. Since its establishment in 1848, the government has evinced the most thorough regard for the technical training of the industrial classes. Numerous institutions are established for the instruction of artisans in designing, and in all the arts connected with industry. The school at Ghent has programmes of study suitable for the iron, cotton, hardware, bronze, and crystal

manufactures, and also for those engaged in the making of chemicals, armor, mathematical and surgical instruments, and there are courses of mechanical drawing, chemistry, natural philosophy, and engineering. In 1881 there were nine hundred scholars. A similar school at Tournay is equipped with a workshop "for the construction of looms, mechanical lock-making, and for iron and copper founding and molding." There is also one at Verviers devoted to weaving, dyeing, and chemistry, while in each of the cities of Antwerp, Ostend, Bruges, Liege, Soignies, Charleroi, and in numerous other towns throughout the whole country, these schools are established, in each case suited to the trade of the place. At the end of the year 1878 they numbered not less than two hundred and twenty, and the pupils 26,736. They were all subsidized by the government, or supported by their respective municipalities.

In addition to these, there were fifty or sixty apprenticeship-schools spread over as many communes, adapted to the special industry of weaving, and they send forth workmen educated intellectually as well as in the preparation of materials, the execution of patterns, and the comprehension and deciphering of designs for the most beautiful productions of the loom, and in all the economies of the weaver's art.

We may learn how warmly exercised is the public mind of Great Britain on the subject of technical education in its bearing upon the manufactures of that country from a recent letter (1881) of the Lord High Chancellor making an appeal for increased support of industrial instruction in the London Institute. He is chairman of the guilds of that city, and he did not deem it deroga-

tory to his high position to address a letter to the city companies asking additional means to enable that institution to insure still greater proficiency among its pupils. He states that technological examinations were conducted in no less than thirty-two different industries that had been held up to that time in eighty-five different localities. These examinations have been very successful, and took place among the various industrial populations of the United Kingdom. He also declares that it can no longer be denied that, in many instances, foreign manufacturers are competing with those of Britain to an extent that drives English products from continental markets, and even successfully rivals them in the United Kingdom itself; and, as a remedy for this, he urges that provision be made for imparting a complete technical education in all parts of the country.

The same views were very strongly expressed by Mr. Walter S. B. McLaren in a lecture before the Watts Institution, Edinburgh, in 1879. In commencing, he said: "At the present time, when trade is worse than it has been for more than a generation; when capitalists are becoming poorer instead of richer; when workmen are receiving low wages, and are pinched for the necessities of life; when our exports are going down, and our imports are going up; when foreign competition presses upon us as it never did before; when foreign workmen can rival and excel us in the manufacture of some articles in which we formerly held an undisputed supremacy; and when foreign masters can undersell us in our home market, the question naturally arises, what is the cause of all this? In my opinion, the chief answer to that question is to be

found in the condition of the schools and workshops of the Continent."

The apprenticeship-school proper had not at that time been tried in Britain, except, perhaps, among the potteries of Staffordshire, or to teach the theory and art of weaving in Yorkshire, Bradford, and Glasgow. And to show how much the British Government is interested in the subject, we may allude to the royal commissioners appointed in August, 1881, on technical instruction, already mentioned. The commission consisted of gentlemen of great experience in that line of inquiry, and they commenced their work in the most practical manner by visiting, in the first instance, the countries in which the industrial school had already passed through a rigorous ordeal, and where they could make scientific deductions from practical results. In the following March they made a partial report which deals exclusively with France, and is devoted to the subjects of elementary instruction and apprenticeship-schools. The report is well calculated to make a strong and favorable impression, more especially with regard to the latter as a method of training skilled artisans. They point out the ease with which the pupils find employment upon leaving school, and the high rate of wages they receive, and that, while being instructed in the various trades, they also receive a somewhat advanced literary and scientific education.

Having made this brief and limited explanation of industrial education in Europe, two questions properly arise :

1. What effect has it exercised upon industry, and what benefit has it conferred upon the industrial classes ?
2. Are such educational methods suitable for the United States ?

In regard to the first point, it might be sufficient to answer that all Europe seems to be in favor of these schools. Not only governments and municipalities establish them as a systematic branch of education, but men of the greatest eminence, and those who are the most competent to form a correct conclusion, advise an extension of industrial teaching for both sexes. This sentiment is as strong in republican France, and frugal Switzerland, and industrious Germany, as in the dominions of the Czar. An opinion so universal could only have its birth in an experience of the most positive and beneficial results. And all concur in attributing to this instruction the introduction of new local industries in the centers of trade, as in Paris, Creuzot, Limoges, Ghent, Chemnitz, and other places on the Continent; and to this influence is also due the general improvement of British manufactures, which now rival in taste those of her neighbors, and has done so much to restore her commercial supremacy in most all branches of industrial art. We have mentioned the Royal Commission to inquire into technical education in foreign countries. In February, 1883, they made a preliminary report, already mentioned, which the Bureau of Education has embodied in a circular as a valuable addition to the current knowledge upon that subject. They refer exclusively to France, and the wonderful activity there displayed in all that relates to the instruction of artisans. Among their conclusions they say: "We think it will be evident, from the account which we have given of the new laws enacted and proposed, that their influence on the diffusion of ordinary and superior primary instruction, both literary and technical, can scarcely be overrated.

It is clearly the aim of the government and of the great cities that this superior instruction shall be placed as fully as possible within the reach of the working-men. The instruction in the use of tools during the elementary school age, besides being of service to every child, whether destined to become a mechanic or not, will tend, in the former case, to facilitate the learning of a trade, though it may not actually shorten the necessary period of apprenticeship. We should be glad to see this kind of manual instruction introduced into some of our own elementary schools." *

By a decree of the French Government, in March, 1880, a Commission of Inspection was appointed in connection with the school of the Boulevard de la Villette, founded by the city of Paris, and which has been described in this chapter. A. Corbon, senator, makes the report, and points out some errors in making the programme of ordinary instruction too advanced for the attainments of the scholars, but speaks well of the theoretical and practical instruction as regards technical teaching, and expresses confidence that it will go on improving, and concludes as follows: "The commission has therefore every confidence that the problem will be satisfactorily solved, and that the first school for apprentices, founded by the Ville de Paris, will be an excellent model

* In August, 1881, a commission consisting of Bernhard Samuelson, F. R. S.; Henry Enfield Roscoe, LL. D., F. R. S.; Philip Magnus, B. A., B. Sc.; John Slagg, Swire Smith, and William Woodall, was appointed by Queen Victoria to inquire into the instruction of the industrial classes of certain foreign countries in technical and other subjects, for the purpose of comparison with that of the corresponding classes in Great Britain; and into the influence of such instruction on manufacturing and other industries in their own and foreign countries.

for imitation." * And H. Tolain, senator, from the sub-commission of the same body appointed to examine into the question of apprenticeship-schools, declares that they "unanimously recognized the necessity for establishing these useful institutions."

These commissions were both formed of gentlemen possessed of various attainments, and whose experience and special means for coming to a correct judgment cannot be denied. And when they finish the collection of data bearing upon the subject of their inquiry, their conclusions as to the value of these institutions will be received by us, at least, with respect, if not confidence. Indeed, the time for pleading the cause of technical instruction is past. The division of labor, the invention of machines, and the decay of apprenticeship, make it the peculiar necessity of the age, and it is, therefore, one of the conditions of industry which it is impossible to change. No wonder, then, that we witness the two greatest industrial nations on the globe employing such vast means on account of manual instruction as a practical necessity of the first order; nor need we be surprised that it is now regarded as the duty of the state and the right of the artisan, from the facts of their industrial life.

The beneficial effect of technical instruction upon the condition of the industrial classes is very forcibly stated in the replies of the British ministers abroad to inquiries

* The Commission is composed of Messieurs Nadaud, deputy (president); Gréard, vice-rector of the university; Tolain, senator; Metivier and Thorel, municipal councillors; De Montmahou, inspector general of public instruction; Clerc, inspector of elementary education; Moutard, professor at the School of Mines; Carré, engineer; Bourdin, late engineer delegate, secretary; and Corbon, senator, reporter.

addressed to them by Lord Stanley for information on this subject. From the selections of Mr. Stetson we give the answer of Mr. Lowther, from Berlin, who says :

The advantage obtained is that there has been a very good class of workmen established which *thinks*, and has a knowledge of the things they are required to make, and consequently comprehends more easily. The class of workmen has also become better mannered, more civilized and refined. The middle class of trades-people has been able to raise the profession ; it has been able to carry into effect all repairs in factories, and to arrange and direct them in such a way that they were cared for in the most convenient manner. It has been able to introduce new methods in manufactures. The high education of German engineers has caused the profession to be very much sought after on account of its extensive and fundamental knowledge.

By means of all these circumstances, Prussian establishments, like Prussian industry, have been able to raise themselves. . . . The workmen feel the influence of the knowledge they have acquired, and are anxious to attend the lectures at their unions which conduce to show the workmen the importance of theoretical knowledge.

Lord Howard de Walden, in his reply, says that the benefits which these institutions have conferred and are conferring upon the working population of Flanders, as regards their material prosperity, and in opening a career of remunerative labor to all who are willing to avail themselves of the opportunity placed within their reach, while teaching them, at the same time, early habits of discipline and order, are incontestable. With his reply he sent the report of the Minister of the Interior on industrial education in Belgium. Of the good influence of the school at Soignies, the minister says: "The school

has a good influence upon the working class and upon the industry of the town of Soignies and the neighborhood. It provides this industry with efficient powers and skilled workmen, who work the stone with taste, and execute the most complicated work, and, above all, remarkable carvings, which the owners of the quarries could hardly undertake before, or which they were obliged to have executed elsewhere. On the other hand, it provides the pupils with knowledge which enables them to improve their conditions considerably. It also acts favorably on their morality, giving them a taste for study, and ideas of order and providence which contribute to the spread of well-being and competency in families."

These communications were made as early as 1867, and since then the schools have greatly increased, and the good influence of art and manual instruction have been extended to a great variety of work which employs skilled labor. M. Haverez, who is at the head of the school at Verviers, describes the extraordinary results of the education at that place, and in his speech he gives an account of a school founded at Lille, designed for firemen and stokers, and of this one he says :

The young workmen received all the knowledge for heating boilers well, and for keeping them in good condition and safety. Those engaged in the working of mines soon perceived that the workmen who came from this school heated the boilers better and with less coal than did other workmen, and that they escaped many accidents and repairs and stoppage of machinery. These firemen were therefore much sought after, and everywhere they were, very properly, able to demand higher wages, because their work was of more value to their employers. Already

in Charleroi, the situations of foremen in collieries, furnaces, and mechanics' shops, are only given to those overseers who have obtained a diploma of the professional school of Charleroi.

Indeed, the advantages conferred by this instruction upon the workmen are corroborated by the strongest testimony and in many ways. The pupils find employment at good wages, their labor brings more than that of ignorant workmen; they are more likely to obtain preferment, for they are more intelligent and more useful; they are better fed, better clothed, better housed, and better behaved; and their condition, morally and socially, is improved in a very remarkable degree.

As to the second point, whether this system of instruction is adapted to the needs and tastes of the people of the United States, that presents a question so far from the line of study and observation of the author, that perhaps little account can be made of his opinion. He, however, can appeal on this subject with great confidence to the views generally entertained and expressed by the most distinguished educators in this country, for they all agree that we ought to have some plan of industrial training. The only question which appears to divide them, or to divide others, is whether it shall be the business of the public school to provide it. Dr. E. E. White, who argues against its introduction into public education, very forcibly expressed his opinion to be for special schools to promote important industries or to meet the wants of classes, and that the State has the right to supplement the public school by special schools for technical training; and in his speech on industrial education before the American Institute, he said: "But, of course, I could take no ex-

ception to all that may be said in favor of technical and industrial schools standing beside the public schools and carrying on this work of education—giving to our youth technical and special training for industrial pursuits. That is what we have got to do in this country. We must have a system of technical training, and the question is, shall we put a system into the public schools, as they are now organized?" and he indicated an opinion very strongly against blending the two systems.

On the same occasion, John S. Clarke, of Boston, read an exceedingly well prepared and philosophical paper on the same subject, in which he traces a theory of practical education for the public schools, in the use of hand-tools in wood and metals, not for application in any particular trade or trades, but for developing skill of hand in the fundamental manipulations connected with the industrial arts, and also as a means of mental development; and he adds: "Secondary schools must provide a way to give broader instruction in experimental and theoretical science; and, also, in a generalized form, instruction in manual training, including the use of hand and machine tools, not in its application to any special trade or trades, nor as a training divorced from general intellectual culture, but as an essential part of a sound general education."

We may remark that these views derive additional strength from the almost uniform testimony of business and commercial authorities. The scientific journals, the trade magazines, and the daily press, all unite in recognizing the necessity of training men and women to become intelligent masters of the principles upon which the useful arts depend, and the practice by which they are made profitable. The reconstruction of our industries,

which has been going on for several years, and which is still progressing on a scale of unexampled magnitude, has rendered the necessity of doing this either a duty of the public, or of the liberality of individuals. Indeed, the new system has already made some progress, and is in a fair way of making more, as we shall show hereafter. We may, therefore, conclude that the relation of education to industry, which is simply to put thought into the hand of labor, is one of the conditions upon which our prosperity depends.

CHAPTER XII.

Education applied to industry in the United States—Impulse given to it—Metropolitan Museum of Art in New York—Mr. Auchmuty's contribution—Instruction in trades, common and decorative—To turn out trained mechanics—New York trade schools—Art school at Trenton, New Jersey—The youth at the potteries—Lasell Seminary—A modified industrial school—Dwight School, Boston—Sewing-classes for girls in Boston schools—Excellent work by them—Art needle-work an industry—For house decoration—On ladies dresses—Code in England—Schools for sewing in Switzerland—Germany—Bavaria—Drawing in embroidery—Dorchester industrial school—Public schools at Montclair, New Jersey—Industrial department—The order of exercises—Industrial art-school in Philadelphia—Mr. Leland's system of teaching the minor arts—Their great variety—Outlay for such a school—Practical results—It revives the popular arts—Useful to all—The Spring Garden Institutê—Mechanical handiwork—Course of instruction—Results—Technological and industrial training schools—At Worcester and St. Louis—Industrial home school at West Washington, District of Columbia—Cincinnati School of Design—A school of industrial art—New mode of industrial education required—Reasons for the change—Subdivision of labor—The general artisan—Great advantage of—Manual and technical instruction the practical want—Appeal to the wealthy.

AND now let us return to our native industries. Education, as applied to industry, is of but recent origin, and has not yet made much advance in the United States; and as we are greatly behind other countries in this tendency, we cannot much longer omit some definite movement for planting the germs of what will become a com-

prehensive system of industrial science. No people can come down, or up, as the case may be, to the practical realities of life more directly than Americans, and when the time arrives they adopt means quite adequate to the necessities of the times. They are liberal patrons of art-work, and this is witnessed by the immense sums they pay for it. Our manufacturers realize the great change which has taken place since the Centennial Exhibition of 1876, and are seeking assiduously, at home and abroad, for skilled workmen, and for the means of giving beautiful forms to useful articles. This impulse has given rise undoubtedly to some isolated efforts at manual training, which inspire the hope that our peculiar necessities are appreciated at home, and that some extended system will be adopted to encourage and foster industrial education.

Among the movements in this direction are the efforts of the Metropolitan Museum of Art, in the city of New York. According to a statement in the New York "Times," that institution opened classes for instruction in designing upon wood and metal. The trustees had no means to carry this experiment out, when a liberal proposition was made to them by Mr. R. T. Auchmuty, to erect suitable buildings for this purpose, and to open schools for some of the decorative arts, such as house-painting, frescoing, and wood-carving; pledging himself to pay during three years any deficiency which might exist between the receipts and expenses. We are also informed that his plan did not contemplate entirely free schools, on the ground that the apprentices would value more what they paid for, and that by a fee, say of \$100 a year, the schools could be made, in time, self-supporting. They are intended to do thorough work, and to

train thorough practical mechanics in artistic trades, who will earn their living by them. And the apprentices trained in these schools ought to be workmen capable of nice design and delicate workmanship. The courses of instruction comprise a general course for beginners, and special courses for mechanics who may desire to improve themselves in particular branches of their trade. Thus, in the school of plain and decorative painting, besides the general course, there will be special courses in mixing colors, in fresco-painting, in the combination of colors in panel-painting, and in the polishing and preparation of hard wood. All these, and similar decorative trades, are in enormous demand in New York, and well-trained young men in them find remunerative business without any trouble. The graduates of these schools would soon, no doubt, equal the foreign craftsmen who are imported to do the best work; and thus there would be a natural and local supply of skilled workmen which, with other facilities, might soon make New York the equal of Paris, Lyons, and other continental cities, in decorative arts. In common trades, such as plumbing, painting, and building, it is notorious that we have few apprentices, and few skilled laborers growing up. Most of the mechanics have learned their trades in daily labor. No one can fail to see the effect in imperfect work. These industrial schools will tend to bring up a class of thoroughly trained mechanics, who will lead their trades, and earn the highest wages; and this, again, by a natural law, will stimulate the foundation of more such schools.

The generous founder of the schools just mentioned, prompted no doubt by these considerations, is already erecting the buildings for them on First Avenue and

Sixty-seventh Street, at an expense of several thousand dollars. It is hoped that there are other liberal citizens in New York who are willing to endow such schools in perpetuity. This experiment of the Museum of Art is a sound one, and might well be the beginning of a great and comprehensive scheme.

We learn from the New York Herald, of August 31, 1881, that the school commenced in the fall of 1880, and has now been in active operation over one year. It drew a large attendance from the first, there being one hundred and forty-eight pupils, who have received practical instruction in drawing and design, decoration in distemper, modeling and carving, carriage-draughting, and plumbing, in day and evening classes. Lectures were given by specialists in the trades and arts, and a prime feature was made of shop instruction to foremen and young men employed in the city.

The school was closed in the spring of 1881, and a wealthy gentleman has given to the same institution \$50,000 to be devoted to the advancement of art-education. The art classes have therefore been withdrawn from this building and established elsewhere on an independent basis, and the artisan classes remain and are known as the New York Trade Schools. The courses of instruction for these in the year 1881-'82 will embrace many new features. There is a large and well-appointed workshop, where instruction will be given in the manual branches of the trades. Attached to this workshop is a collection of articles and materials used in plumbing. Dr. Chandler, of the Board of Health, and Professor Egleston, of the School of Mines of Columbia College, will take part in the series of lectures to be given to the classes.

An art-school has been founded by the manufacturers of pottery at Trenton, New Jersey, to be attended by potters' apprentices. There are few artistic trades in this country where more could be done if there were a sufficient supply of skilled labor. Why should we import such immense quantities of these goods, and employ so many English and French workers in this beautiful industry, when we have such abundance of means in our own country for the business, both in excellent clays and generally intelligent labor, except for the want of special training in the workmen?

We are not informed as to the course of study prescribed in the Trenton school; but at last accounts it was an assured success. The youth of the potteries have taken to it in a manner that has surprised the more sanguine expectations of its founders, and they study as if their future advancement in the business depended entirely upon their efforts in the art-school. The school will undoubtedly be extended, and classes added for the best pupils.

A very favorable account is given by a correspondent in the Washington Republic of an educative experiment at Lasell Seminary, in Auburndale, a small town some ten miles from the city of Boston. From an experiment, however, the school seems to have advanced to an established and permanent method, which is determining in its influence. This plan is a modification of industrial instruction introduced on the same footing with technical study. The manual labor department of a girls' school has had, and in many cases will have, its place, but to produce good results it requires the necessities to meet, and also exceptional girls, both in physical and

mental strength, to receive its benefits. At Lasell, classes are taught cooking and sewing, just as they are taught mathematics or music, as an essential part of a woman's education. The cooking lessons are under Miss Parton's tuition, and they are treated with all the deferential consideration due to solid geometry or metaphysics. It dates back to 1857, when it was established by Professor Edward Lasell, of Williams College, a pupil of the well-known Dr. West, of Brooklyn. Its Principal is Professor C. C. Bragdon, a graduate of the Northwestern University of Illinois, a man whose intellect is eminently alive to genuine advancement and practical progress. The seminary is beautifully situated in large, shaded grounds, with pure air, and a sunny aspect that charms the visitor like magic, and is fitted up with steam heating and all modern improvements. Professor Bragdon's ideal of a girl's education is to make it a development and a discipline that will enable her to take hold of life for herself, to come out with implements by which she may be independent, self-supporting if necessary, and which will fit her to create a home. "But does not cooking and dressmaking interfere with studies?" asks some one. No more than studies interfere with each other. Greek is not studied less because of German, nor does mathematics suffer from a knowledge of history. For the majority of women the interests of home are to be the predominant ones of life, and whatever fits her for that gives her a vantage ground. If it can be inspired with a spirit, a purpose, it is thus redeemed from drudgery. Our American girls are mostly to be housekeepers, happy wives and mothers, and a professional training in domestic arts, combined with the fine advantages offered

in technical study, render Lasell Seminary an ideal school for girls. It is a genuine home-school—one whose influences are all refined, pure, and elevating.

The "Journal of Education" has the following notice of one of the schools in Boston :

The friends of "industrial education" will be pleased with the report of the master of the Dwight School concerning an experiment which has been going on in his building during the past year. It is not very long, and was given to the board last month. This experiment in industrial or manual work was begun last January with a class of eighteen pupils. They were selected from the graduating class, and the second, third, and fourth classes. School discipline was maintained, and each boy was marked on the work done. The report says: "From the beginning to the close, the school went on with unbroken and successful regularity. The teacher was promptly on hand, the order was good, the pupils interested. It was delightful to see the eager desire manifested everywhere in the room to do the day's work well. There was no absence, no tardiness. On one occasion a count was made, and seventeen out of eighteen pupils were found at work at one o'clock, when two was the hour for beginning." In its effects upon the standing of the boys in the grades from which they were taken, the master says: "Here and there a complaint was made by the teacher of some second-class boy, that he was not doing his work well in his own room; but the pupil, in every case, was so anxious to remain in the 'carpenter's class' that a word or two of warning was sufficient to bring his performance up to standard again. As far as the first class is concerned, no boy fell below the required per cent for graduation, and each boy received his diploma."

It is also encouraging to know that classes of the girls attending the public schools in Boston are taught in

sewing as a part of their education. All who are interested in the education of girls have urged the necessity of teaching them this branch of industry, and the experiment has been attended with most satisfactory results. Both parents and teachers give positive proofs that the time and attention taken from other studies have been most profitably devoted to these practical lessons. The children are pleased with the work, and much of it is beautifully done. They cut garments and make dresses with skill and talent, and the little girls soon excel their mothers in the use of the needle. Indeed, it is said that the latter take as much interest usually in it as the children. A teacher remarked to a visitor that he knew parents who would be willing to endure much before they would permit their children to leave school for that reason alone. He also added that many of them earned their living by the use of the needle, and the number had not been small of those who had come back after graduation and told of remunerative positions they had secured through the knowledge of sewing they had obtained at school.

In this connection we may say that an advance is also observable in art-needlework, which is rapidly developing into an industry. It appears that Mrs. Booth, the editor of Harper's Bazaar, has recognized the wide-spread desire for information in this almost forgotten art, and she has made a special arrangement with the South Kensington Museum by which the designs from that art-school are to be published in that journal. The Bazaar also publishes designs furnished by the Vienna and Nuremberg schools of art-needlework.

The magnificent style of decorating the houses of the

wealthy has taken the direction of art-needlework embroidery. The designs are often reproduced from old French and Italian tapestries, and many of them are made from nature; and plants, flowers, and leaves are constructed by conventional treatment into original and highly decorative designs. Abroad, the work of the Kensington and other schools has gained great celebrity, and the finest designs by Morris, Crane, Burne Jones, and other famous ornamentists have been wrought out on rich fabrics by ladies who found therein an agreeable and needed employment.

With us the groundwork is velvet, Oriental stuffs, brocaded silk, lace, and other goods in vivid colors and changing hues. Artistic *portières*, rich draperies for cabinets and windows, and for the decoration of walls and furniture, are embroidered with branches of trees and flowers, having borders upon which are worked figures of various kinds in gold and silver thread; muslin curtains embroidered with gold to shade the deep bay-windows; exquisite pale satin with roses, and sometimes the form of a sea-nymph half-risen from the water beneath the changing blue of the sky, and other ornaments in the most delicate colors to imitate the precious stones; all of which harmonize with walls upon which are suspended rare and costly paintings, and Limoges enamels of wonderful beauty which adorn the drawing-rooms and *boudoirs* of the wealthy in our cities. Any design which will produce decorative effect is now used in embroidery.

Perhaps the most ingenious way in which this art is used is on ladies' dresses, cuffs, collars, and even stockings, which are often decorated with gold and silver

spangles, and clusters of berries which shine and sparkle between the instep and the short costumes now in fashion.

Among the employments which belong almost exclusively to women this is perhaps the most fascinating, and it is one which can never be superseded by the sewing-machine. Its votaries are found among all classes; those who are well off being as eager in this lady-like art as are their more unfortunate sisters.

The proposed revision of the educational code in England provides that sewing shall be made compulsory for all girls, and even for the boys who are under seven years of age. The latest reports show that in Switzerland 4,373 females are employed in schools teaching needlework alone; and in all the people's schools in Germany, as well as in the numerous girls' schools, sewing and needlework are added to the other studies. In Bavaria alone there are over fifteen hundred schools in which this is a regular part of the programme, to say nothing of her thirty-six technological institutions, her polytechnic school at Munich, and four agricultural colleges.

Every effort to afford practical instruction in this ingenious and refined art will receive essential assistance from its being made a requisite part of public education. Instruction in drawing is necessary in order to enable the pupils to prepare, as well as understand, tasty designs in embroidery. It is a matter of common observation in the Boston schools that those who excel in drawing excel likewise in sewing; but that is not surprising when properly considered, for it is merely a training of the hand and eye in either case.

Before leaving Boston, we find another instance of a

small industrial school in Dorchester, now a part of that city, which has existed ever since 1853, for training girls in domestic affairs and other avocations. Its object has been to take poor and unprotected children and train them to good personal habits, to instruct them in household labor, to exert a moral influence and discipline over their conduct, and to qualify them in methods of earning their own livelihood. A writer in the Boston Transcript says :

Of those who have passed through the school, many are well provided for in homes of their own, many others supporting themselves honorably by nursing, cooking, parlor work or housework, or by trades of various kinds. This school is wholly supported by voluntary contributions.

This reminds us of the practical plan of Mrs. Elizabeth Thompson for establishing Kindergarten homes, and to remove thus away from their miserable surroundings and temptations the poor children in the cities who are likely to become inmates of poor-houses, asylums, and prisons, and teach their hearts to be good and their hands to be useful in industry.

As the public schools at Montclair, New Jersey, are the very first, it is believed, in this country to adopt an industrial department, some little detail in explanation of the movement is excusable. The facts are derived from a friendly observer, but are undoubtedly substantially correct.

The origin of industrial instruction in the Montclair public schools may be traced directly to a spirit of opposition to the high school, in which the higher branches are taught, and boys and girls prepared for college. A large number of voters claimed that the taxes necessary to

support the high school directly benefited but from sixty to eighty scholars, when the larger proportion of those who attended school, being obliged to leave before they are fourteen years, not only derive no 'advantage from the higher educational facilities, but have to go into the world without any practical knowledge whatever.

To counterbalance this apparent inequality in the different departments of the educational system, a committee of ladies and gentlemen was appointed at a meeting of the legal voters of the school district, held July, 1881, to examine the various plans of technical or industrial education in practical operation, and to report at a subsequent meeting as to the feasibility of incorporating with the grammar school a department for technical instruction. During the ensuing school year the committee examined the plans and workings of various industrial and technical schools in Philadelphia, New York, and Massachusetts; and in May, 1882, presented their report, in which they stated what they had seen and done in the premises, and recommended the formation of an industrial department in the Montclair public schools. They recommended further, that the instruction afforded by such a department should not be technical, but should be designed and adapted to impart, as far as possible, a general knowledge of the use of tools, and to inspire the pupils with confidence in their own ability to do something of a practical nature. To carry out this plan an appropriation of \$1,000 was voted at the annual appropriation meeting in July; and in September, 1882, the system went into effect. The plan followed was substantially that adopted by the school of Gloucester, Massachusetts; i. e., a two years' course of instruction in the use of wood-working tools,

and the two classes, numbering some thirty-five each, were selected from the second and third grades of the grammar department, as those who would be the most directly benefited by such instructions. Their ages are from eleven to fifteen years.

During the six months that have already elapsed each boy has received weekly two hours' industrial instruction. After fitting up the shop, the procurement of a suitable instructor became the question of greatest importance. The trustees found that with the limited funds at their disposal they could not command such services as they desired, viz., those of a young, reliable mechanic who should be not only a master of his trade, but have the additional faculty of imparting his knowledge to others and of exciting the enthusiasm of his students in their work. They finally secured the services of a capable master-carpenter who thoroughly understands his vocation.

The natural tendency of the pupils was to regard the work-hour as a time for recreation, and it took some time to impress upon them the fact that it was as much a part of the school exercises as any recitation. The class has been taught, in order, the use of the hammer, saw, chisel, and plane; and the principles of cutting, squaring, and joining wood, including the art of mortising and dovetailing. At present they are engaged in making pine and walnut frames. On the whole, their work is very creditable. No attempt is made to derive any profit from the work, such a step being deemed for the present inadvisable.

Of the practical results obtained it is too early to form any reliable opinion. In making the experiment, boys have been taken into the classes without regard to their aptitude, and those who expected to see them in three

months develop into mechanics have been disappointed. It certainly has given the pupils knowledge of a practical character which will be of use through life, and it has also, observably, made them more self-reliant. The expenses of the current year may slightly exceed the amount of the appropriation. It is not expected that the boys shall become proficient in any of the work taught in the class unless by means of outside practice. The aim and object kept in view is to develop an inclination for mechanical pursuits, and to so far familiarize them with the general use of tools as to foster and encourage a desire and purpose to master their use, by the exercise outside of the class of the principles and modes of practice in real work. The tools are all numbered and stored in a series of tool-chests, and a set of tools is allotted to each boy in each class, who becomes responsible for their care. Each pupil has his own place at the work-benches.

The order of exercises consists usually, first, of an explanation, by means of a blackboard, of the work assigned for the hour, and of the principle involved, and of the proper order of detail and practice. The actual use of the tools is then proceeded with, each boy in turn receiving such immediate instruction as may be required. The technical rules for the best method of work in the accomplishment of the matter in hand are given, and pains taken that the boys shall become familiar with their practical application. Thus far, the classes have been taught the proper use of the hammer, plane, saw, and chisel; and the sharpening and care of tools; and in the use thereof have been taught the art of planing neatly, of joining rough edges truly and squarely, of sawing truly with both rip and crosscut saws, of boring accurately and to a pur-

pose, and are now engaged in making dovetailed joints, and forming neat miters, mortises, etc.

As in all other studies, there is a wide variance in the proficiency of the several scholars, but all have been manifestly profited, and greatly interested and pleased, in discovering the possibilities of power and self-help found latent in their own hands and fingers, and which they can master, and, by proper development, with the aid of a few tools, make serviceable for their own profit and the enjoyment of others. No text-books have been used or recommended, the teaching having been wholly confined, thus far, to oral and practical instruction without study outside of the class-room.*

* The lesson of December 2, 1882, was for making frames about a foot square, and the following rules were placed upon the blackboard. It is given as a sample of the work on which the pupils were engaged:

1. Gauge strip $3\frac{1}{4}$ inches wide.
2. Plane to gauge-mark, using jack-plane, jointer, and try-square.
3. Gauge all round the strip $\frac{1}{4}$ of an inch from marked side.
4. Plane to gauge-mark, using jack-plane and jointer.
5. Gauge strip $1\frac{1}{4}$ inches from each edge, also in center of the two gauge-marks just made.
6. Rip the strip in two at the center gauge-mark last made with a rip-saw.
7. Plane the strips to gauge-marks, straight and square, using jack-plane, jointer, and try-square.
8. Saw the strip, marking from pieces $12\frac{1}{4}$ inches long.
9. Gauge the pieces on each end in center of thickness, also on their edges from the ends two inches up.
10. Mark round the pieces with pencil $1\frac{1}{4}$ inches from end, using try-square.
11. Saw down on flat side to gauge-marks, also down the ends to meet the cuts just made, sawing out the halvings, using crosscut-saw.
12. Fit halvings together, using paring-chisel, keeping the frame square and "out of wind."
13. Fasten corners with screws.
14. Trim corners with smoothing-plane and saw.

We have dwelt upon this instance as an example for other places who might wish to follow it, in order to give facilities to their youth for acquiring instruction which is so necessary in the industrial pursuits.

A system of instruction in art-industry has been in operation for two years in the Hollingsworth Buildings, Locust Street, Philadelphia, under the management of Mr. Charles G. Leland, and it has already established a remarkable character of its own. Few things of an educational kind are more interesting than the accounts which come to us of the wonderful success of this undertaking to teach industrial art in the public schools of that city. The Bureau of Education has issued Circular 4, 1882, which was prepared by Mr. Leland, explaining his theory of hand-work in public schools, and the result of his experience in the practical work of teaching it; and no one can read the report without feeling a lively interest in this effort to educate the eye, the hand, and the mind, at the same time.

As a preparation for industrial art-work, it is necessary that the pupil should be able to design. Drawing is therefore the first step, and Mr. Leland claims that by his method of teaching it can be learned in much less time than is usually required, besides teaching at the same time the application of the art in practical work, so as to enable the scholars to earn a living at once by making something that can be sold. From drawing a straight line the pupil proceeds immediately to outline ornament for decorative work. Tracing and the aid of ruler and instruments are permitted, but are soon abandoned, and in a very short time a boy or girl of ordinary capacity can design beautiful original patterns which are made to serve ex-

clusively upon the work of the student. Only practical results are aimed at. Great importance is attached to free-hand drawing, and it is taught with special reference to the studies of the school. The principles of construction lines receive some attention, but geometrical forms do not appear to be of much account in the plan of instruction, and perhaps it is unimportant to the purposes of the system.

After pointing out the order of industrial development, the circular alluded to proceeds thus :

This universal truth, that man develops the ornamental, during the infancy of every race, before the useful, is illustrated in every individual. The child, who cannot as yet make a shoe or file metals or master a trade, can, however, learn to design decorative outline patterns, mold beautiful pottery, set mosaics, carve panels, work sheet-leather, and *repoussé* or emboss sheet-brass. He or she can cut and apply stencils, model *papier-maché*, or *carton-pierre* (a mixture of composition and paper-pulp), inlay in wood, and make a great variety of elegant objects. If a child can learn to sew, read, sing, draw, and model in the Kindergarten, it can surely pursue higher branches, both literary and manual, in higher schools. The system on which this industrial art-work should be taught is as follows : It does not merely consist of certain definite branches, such as modeling or carving according to patterns ; *it is the learning how to design the patterns, and then working them out in any material*, such as wood, clay, brass, embroidery stuffs, or stencils. There are fifty or a hundred such minor arts, and anybody who can draw or design can with very little practice in a few days execute them fairly in any substance which will retain impressions. It is a remarkable law of nature or of humanity that all the minor arts, or such branches of industry as are allied to ornament, are very easy, and can generally

be so far mastered in a day by anybody who can draw, as to enable the pupil to produce a perfectly encouraging result. But industrial art, to be taught in schools, need not and should not be limited to ornamental work. This is to be at first followed, simply because it is the *only* work easy enough for children and girls. Carpenter's work, or joinery, in its rudiments, or in fact any branch of practical industry, may be taken up as soon as the pupil is fitted for it. Industrial art in schools covers the ground or fills the time intervening between the Kindergarten and the industrial school, but it blends with and includes the latter. It is characteristic in this, that the system, as I conceive it, is capable of being introduced into every public or private school in the country, or into any institution where there is a preceptor who has some knowledge of drawing, with sense enough to apply it according to certain elementary hand-books of art.

The school began its work in April, 1881, with nearly a hundred pupils, half teachers and half scholars. The children are from twelve to fifteen years of age. Every teacher in the public schools selects one or two scholars. These are divided into two classes, one attending on Tuesdays from 3 to 5, the other on Thursdays at the same hours. When the pupils can make a fair original design, they learn painting, modeling, carving, embroidery, or metal work. They are, however, variously occupied, some in painting plaques and tiles, some in carving walnut panels, or in making brackets, doilies, tidies, chair-backs, hammering brass-work and different kinds of sheet-metal, and still others in a variety of modeling, ornamenting, and glazing clay-work, and the girls in designing patterns which they work in outline embroidery; and the work thus done is of such a character as to be suitable for decorative effect, and as can be readily sold for a good

price in the market. The operations in modeling are taught in systematic treatment, and embrace a great variety of plastic objects, such as jars, vases, flowers, fishes, branches, vines, and leaves, in which each pupil carries out his own design according to his own liking, and no uniform rule has been adopted except that it must be original. The work in sheet-metals and in wood-carving gives evidence of skill even in those who have not practiced it longer than a few weeks; showing that this kind of skill can be easily acquired by any child in the public schools. Very excellent specimens in drawing are exhibited at the table devoted to that study, from the simplest forms up to well-developed ornaments, and are afterward successfully used on the material of their work. Art needlework is taught before plain sewing, as it is said to make the latter easier in the end. The art of stenciling, or flower-painting on cloth, is practiced, the picture being surrounded by an outline of needlework, producing very salable articles by means of their beauty. Practice in drawing and modeling, owing to its great variety, leads gradually to tempered beauty in original designs upon *repoussé*-work, on carved wood, vases, and jars, and in patterns for embossed leather, wall-paper, carpets, mosaics, inlaying, and articles of furniture, for the execution of all these may be intrusted to the pupils and sold for their benefit.

The outlay for a small school or club on the humblest scale is estimated at not more than \$20 or \$30. The requirements of a school on a large scale for a city would be more. The school board at Philadelphia appropriated \$1,500 in the year 1882 for the maintenance of the school, and it was confidently asserted that it can be made

entirely self-supporting, if not profitable, by means of the work done by the pupils.

Of the practical results it is stated that there is a great demand for boys with such knowledge as is acquired in this school, and Mr. Leland adds: "I could without exception find places in a great variety of manufactories for all the pupils in the public industrial school who have had about twenty lessons in design and modeling. . . . In a few weeks all who have advanced beyond design produce work that has a market value."*

The instruction in this school revives the traditions of these humble arts, many of which are almost forgotten, and some of them introduced for the first time into this country. They are not an invention. They constituted the popular art of the past, when the people had to help themselves to what was useful and beautiful, and when, consequently, the households of the common classes were made somewhat attractive by beautiful specimens of mod-

* A correspondent writes to the "Decorator and Furnisher" as follows:

The city of Philadelphia is the sole proprietor of the school, and through it has originated a reform in education which has never before been fully practiced either in Europe or America.

This experimental school has been frequently visited by distinguished foreigners, as well as by many Americans, who have come to the city for the express purpose of examining it.

The visitor will see about forty pupils engaged in studying designs, about as many more modeling vases, etc., in clay, with color and glaze, carving in panels, embroidering, and painting in oil, etc.

What these children are doing is to qualify them for the workshop or to teach. That the project is a success will appear from a few facts. A practical manufacturer has taken many of the pupils, and pays them well, as he regards them sufficiently well trained to be of use as designers.

A situation with good pay has been offered to a girl of fourteen, and one of the boy-students during his vacation of two months earned \$218.

eling and by designs in their furniture and domestic utensils. The plan of the institution revives the art-instincts of the people, and utilizes them in numerous branches of remunerative labor. It deserves the fullest recognition for the careful and systematic advancement of industrial art; especially since it is a department of the public school in a city so largely engaged in the interests of art-industry. Moreover, it has a practical value to thousands of children that cannot be estimated, for, under the instruction here afforded, though entirely ignorant of any useful pursuit, they can become skilled in a great variety of hand-work, which will at once make them self-supporting, and which will be of great service even to those who do not need to earn a living, as there is scarcely a situation in life where a knowledge of these simple arts will not be useful, and a source of endless enjoyment to all who can practice them.*

The Spring Garden Institute, of the city of Philadelphia, has an industrial department fitted up with benches, a forge, machine-tools driven by a gas-engine, and all the appliances of a first-class workshop. Instruction is given in mechanical handwork to classes meeting at night. It has a capacity of thirty-five pupils per night; each class meets two evenings per week, so that instruction can be given to about one hundred and five individual pupils, and it is used to its full capacity. The tuition is

* Since the publication of the former editions of this work, I learn that Mr. Leland has been for some time in England, and with the assistance of Mrs. Jebb has founded "The Home Art Association," and many persons with titles are among its directors. They have from recent accounts over two hundred schools or classes all over Great Britain, teaching the minor arts entirely upon his system of applied design. This circular is still the only handbook on its subject for both America and England.

fixed at five dollars for two evenings per week for three months.

Instruction in the metal course embraces filing, turning, drilling, forging, and the mechanical work and drawing connected therewith ; the vise-work comprises twenty-six vises and one hundred and sixty running feet of bench-room, and instruction is given in every kind of filing on cast iron, steel, brass, and wrought iron. In regard to machine-tools, the shop is furnished with an engine, power planing-machine, lathes, drill-press, and the necessary shafting, so that every opportunity to learn their practical use is afforded to the pupils. Besides, a modern forge has been provided, embracing the tools necessary in forging and welding, whether the work is simple or intricate, and molding and casting in practical founding work will be added (if not already added) at the necessary moment.

It is the design of the managers to teach joiners as well as machinists, and for this purpose to introduce classes in wood-working, wood-turning, carpentry and cabinet-making, pattern-making, and other branches of that industry.

A very large number of the pupils are machinists or employés in machine-shops, who, in the absence of such instruction as was afforded to apprentices under the old system, seek this school as the best place in which to acquire a broad knowledge of the trade at which they work and special skill in the handling of tools. In the annual report of 1881 it is stated that, in the natural course of events, the schools have become employment agencies for the pupils who enter them, and, as a result of the instruction given to the pupils, many of them have obtained de-

sirable situations, and others have been advanced in their chosen professions.

The publications of several technological institutions show that they have excellent manual training-schools, in which the pupils are taught a variety of mechanical operations, including the use of tools and machinery in working upon wood and metal. The Worcester Free Institute and the Washington University at St. Louis, already mentioned, manufacture articles for sale, and are managed very much like other machine-shops, only that the pupils learn the science as well as the practice of mechanical art.* The shops are fairly equipped with machinery, and the instruction must be of excellent quality, for it is imparted by men of reputation in their profession, and the students they send out become civil and mechanical engineers and skilled workmen, and find situations as superintendents and foremen in other shops without difficulty. These schools are yet in their infancy, and are not sufficiently endowed so as to make instruction free, and they require assistance in order to advance the work to that point, and extend the sphere of their usefulness to all.

The Industrial Home School, situated in West Washington, District of Columbia, is another step in the path of practical education. It combines the advantages of a school and a home, to which are admitted a number of boys and girls—the children of poor parents, to be taught, besides the ordinary school-lessons, such industries as will fit them for the duties of life. The boys are taught many useful trades and employments, while the girls receive instruction in the various household and other duties appropriate to their sex. The principle upon which the school is founded comprehends the best training for chil-

* This is a mistake. Articles manufactured in the workshops of the Washington University are not for sale.

dren in this world, that is, their symmetrical education by giving due consideration "to their mental, manual, and moral endowments. The mental is provided for by the public school, which is already a part of the education of this Home School. The manual is attaining importance by the industries which are already in successful operation in this school, such as shoemaking, gardening, cooking, sewing, and wood-work. And in this Cottage Home will be exemplified moral training, far better than it is at all possible by what is known as the system now happily passing away." The ground for the Cottage Home was broken for the building in the early summer (1881), and the institution has received the hearty sympathy of the friends of practical education, many of whom have devoted their best efforts to its success.

The Cincinnati School of Design exhibits a unique development of technical study and instruction in the practical work of some of the skillful industries, such as wood-carving, designs for work in metal, decoration of furniture, painting on china and porcelain. The students are of both sexes, and the course of study commences with lessons in drawing and the primary principles of design; and when they can draw a limited number of leaves, flowers, birds, and vines, they are instructed in the true principles of decoration. In the report for the year 1878, as a proof of the efficiency of the school, a list is given of names and occupations of students who have turned their training to practical use, the record covering eight years. There are two hundred and eight names, fifty-four of them those of women. Lithographers, designers, sculptors, engravers, landscape-painters, and even sign-painters and "stripers," architects, decorators, turners, and others are

mentioned in this list, and twenty-one persons are named as engaged in carving or other work in wood. The list, however, gives the names of those pupils only of whose subsequent course the teacher of drawing has positive knowledge, and a foot-note explains that the list includes but few of the members of the classes in carving, "for the reason that the larger number of the pupils in those classes have employed their talent in beautifying their own homes rather than in the production of objects for sale; all of them have executed valuable pieces of work, and could earn a living by carving and designing were they so inclined." The only manufactory of carved wood in Cincinnati can probably be traced to the existence of the School of Design.

We have emphasized these few examples of the Industrial School because they are new in this country, and, like almost every other innovation, will encounter many difficulties before they succeed in attaining a solid foundation. They show the progress already made, and should serve to encourage the friends of industrial education by the promise they suggest of still greater progress in the future. The old system of apprenticeship is already dead, nor is its general revival either possible or desirable. The great change in our industries requires a corresponding change in the mode of learning them. A knowledge of a handicraft now includes some proficiency in art-science, and has become an exponent of intellectual capacity. Most of the manual occupations require some instruction in the art of drawing and in the theoretical as well as practical elements of art-education. This was not attainable when the apprentice picked his trade up in the course of daily labor, and his master was as ignorant as himself

of the related principles. He learned slowly, for much of his time was occupied in unskilled work and menial service, and indeed his lot was often that of a mere drudge. Our industrial establishments, moreover, are on a surpassing scale of expense and mechanical perfection, often employing a thousand workmen; and the individual mechanic, working in his own shop and giving scanty information to his apprentices, is fading out before the energies of modern skill and perseverance. We might as well find fault with this revolution as with the railway for taking the place of the stage-coach. Besides, we must remember also that our workshops are much more systematically organized, and that the work is split up into various subdivisions, so that each mechanic works only upon a mere fragment of his trade. It is said that in the Waltham shops a watch passes through the hands of seventy or eighty different workmen. It would be impossible for the young artisan to acquire anything like a general or scientific knowledge of his trade in a regular workshop. At the most he could become only a fragment of a workman. In several of the wood and iron trades this splitting-up process has been going on until a generally skilled artisan in them is becoming almost unknown. It seems reasonable that this difficulty may be met and overcome by an industrial and technical education which will make workmen in the start by sending out graduates who understand the general application of scientific principles in the use of tools and machinery. There will in the nature of things always be a demand for the general artisan in the management of large establishments, and he will possess that great advantage over his fellow-workman who has only got a small section of his trade.

This transition in our manufactures and commerce demands a corresponding change in the education of the industrial classes; and it is almost universally conceded, by those who have considered the question, that manual and technical instruction, while acquiring a trade, will supply this want. It is the trained hand that can turn general knowledge and sound theories to practical account, and thus secure the physical prosperity which results from steady and remunerative employment. It is this which can redeem labor from its servile tendency; for when labor is pursued without skill or cultivation it is very sure to deteriorate into mere brute force. Here, then, is the idea distinctly presented to our mind: we know what is wanted, and it is occupying our earnest attention in its gradual development to an established method. We know that the advance of an idea has in some instances been singularly tardy. But the experiment has been tried in Europe and on a small scale in the United States. Public-spirited citizens in our large cities should place sufficient sums of money at the disposal of the educational authorities to inaugurate such schools in accordance with the peculiar wants and industries of the locality; and much of the time and means now expended in studies which only serve to gratify taste, and will never be of service to the pupils, might be more profitably devoted to practical lessons in the proper pursuits to be followed in after-life.

CHAPTER XIII.

Industry a matter of state importance—Schools for industry to be established by the state—Course pursued by Great Britain—Art-schools and drawing in England—Effect of, on prosperity—Manual instruction correlated—How to treat the question—Not to be introduced into the school-room—Dr. White's and Mr. MacAlister's views—Schools at Montclair and Philadelphia—Manual training in Europe—It improves the pupils—Public opinion—Conflicting opinions and objections—Statement of the same—Diversity of views—Mr. Stetson's—Dr. White's—United States' limited provision for industrial education—Consideration of popular objections—Instruction in the use of tools and machinery—Illustrations—Pursuits that resemble each other—Mechanical powers—Trades easily learned—Occupations will multiply—No danger of glutting them—Mode of industrial instruction—Moderate instruction at outset—Pupils with a general knowledge of hand-tools prepared for a variety of trades—Illustrated by Mr. Leland's school—A community of skilled workmen, its value—Further notice of industrial schools in Europe—Statement of M. Rossat—School at Charleville—Industrial training in French elementary schools—School of the Rue Tournefort—The French act of 1880—Programme of the commission—Report of H. Tolman, senator—Conclusions of the Boston committee—Views of Mr. Steel—Important as coming from the right quarter.

BUT the time has come to extend our view beyond these individual and scattered efforts, for it is claimed with much semblance of justice that the interdependence which exists between manual education and the industrial prosperity of the state is a subject of too much impor-

tance to be safely left either to the speculations of the mere philosophical theorist, or to the narrow and short-sighted views engendered by personal or local interests; and it is therefore asserted that the state itself should recognize the relation between a high type of manual education and the great interests of material prosperity, just as it makes provision for the cultivation of the mental powers, and all that goes to make up the moral and intellectual capacity of the community; and it is suggested that, as the common welfare becomes fixed and possible only by the joint labor of mental and physical endowments, the education of each should to some extent *pari passu* accompany the other. It is argued that industrial schools should be established by the state; or at least that opportunities for industrial instruction at its expense should be provided in different districts, to be determined, of course, by the pursuits and experience of the people.

When Great Britain found herself outstripped at the Crystal Palace Exhibition, she "faced the music" at once, and established the South Kensington Museum, with its annexed art-schools, at an expense of six million dollars. There are now (1882) nearly two hundred art-schools in England, where thirty thousand people receive instruction; and the progress is still more remarkable in the way of general education, for there are not less than four thousand two hundred schools where drawing is taught, and where nearly a million pupils are instructed in drawing and design. Between 1874 and 1878 Parliament expended over one million dollars in aid of drawing-schools and museums of art. Says the author from whom I take these facts: "The English were eminently a practical

people, and thought this an excellent investment to increase the wealth of the nation; . . . the English now surpass the world in certain kinds of articles." We may confidently affirm that the wealth and business prosperity of Great Britain are to-day owing as much to these schools as to any other cause, for by means of the improved appearance of all her mechanical products she has been enabled to regain her mastery all over the globe. She took the lesson of the Crystal Palace to heart, and set an eminent example of renaissance in her industrial art through the active agency of the Government.

Much of the instruction received in the English art-schools, such as drawing, geometry, etc., has been recently introduced into our public schools. If these were developed in close connection with the expedient of manual instruction, which would show the practical application of the knowledge acquired by the students in these studies, public education would then be fixed upon the immovable basis of industrial rights and conquests. The fact must sooner or later be recognized, that manual instruction is correlated and inseparable in any adequate system of public teaching; and that it is important that provision be made where our youth can be taught who intend to engage in industrial pursuits; for without this assistance our skilled industries can not be carried on except by the importation of that species of labor from other countries.

The sneering observation is frequently heard that the public schools cannot be expected to turn out ready-made smiths, carpenters, wheelwrights, masons, brick-layers, shoemakers, tailors, and farmers. This is, of course, intended to be a crusher, and to settle the matter peremptori-

ly. It is not exactly, however, upon this principle that the great question of industrial education is or ought to be treated. Good men may and do differ as to the best mode for the practical instruction of a whole community; but they ought not to be embarrassed by a superficial slur. Even if this were the purpose of manual training, it would be as little a reproach to it as it is to the present system that it turns out so many ready-made clerks, book-keepers, accountants, insurance agents, and students prepared for entering college. The way in which manual training ought to be carried on, and the extent to which our public schools can be used for that purpose, is of course a question that will receive a variety of answers. It is not intended to introduce the pegging or the sewing machine, or any other machine into the school-room. Upon this subject there is much misunderstanding; for, while the state has clearly a right to direct the ingredients of the education it freely furnishes to all, it is not intended that work and study are to occur in the same apartments or even in the same building necessarily. For instance, Dr. E. E. White, who strenuously objects to manual training in the public schools, is perhaps under this erroneous impression, for he qualifies his objections by saying: "Of course, I could take no exception to all that may be said in favor of technical and industrial schools, standing beside the public schools and carrying on this work of education—giving to our youth technical and special training for industrial pursuits. That is what we have got to do in this country. We must have a system of technical training, and the question is, Shall we put a system into the public schools, as they are now organized?"

And Mr. MacAlister expressed his opinion to be, that

alongside the high-school there might be a manual training-school that should fit the pupils to enter in advance upon those industrial occupations that they intended to follow. These gentlemen agree that industrial education is valuable, and that there is no objection to any measures for its promotion, if the schools for that purpose are placed by themselves. We see that things have taken that course already. There are at least two instances of that kind described in the preceding chapter—the shop which was fitted up for industrial instruction in the town of Montclair, and the room devoted to industrial art in the Hollingsworth Buildings, Philadelphia. They are both designed as accessories to the common school, separated from it, and yet contiguous enough to accommodate the public-school children; and the extent to which they have achieved success is rapidly solving the problem of industrial education in the United States. The question of manual and elementary instruction is now scarcely an open one, for the formula of reconciliation between them has at length been discovered; and the two forces, instead of being rivals, are becoming good friends. Besides, it is a matter of general observation that manual training and ordinary teaching have been conducted in distinct parts of the same school for many years in Europe; and that generally the effect of this has served to enlarge the faculties, refine the taste, to give clearness and breadth to the intellect, to make the character more helpful and self-reliant, and to start the pupils with the best prospects of success in the practical ends of life. Education can by this means be made a unit, and not a fragment. Indeed, this system of commensurate education is demanded by reasons more imperative than those which require the

high-school for a superior training in music, languages, and the courses preparatory to entering college.

The interest felt in this question is but partially exemplified in the few schools in this country, for it is spreading to our business centers, and this volume might be filled with passages taken from recent books and magazines, from newspapers and speeches, manifesting the disinterested and moral activity of public intelligence upon the subject.

At this point it will be convenient to consider some of the conflicting opinions and popular objections to industrial education in public instruction. Many persons believe that it would prove of incalculable benefit to the community at large and to the industrial classes in particular, but they are all at sea as to the method to be adopted. Doubt, they say, exists as to the duty of the public to fit every young man for a trade or profession. The assumption that this is a work belonging to private effort is acquiesced in by many people who believe that industrial education in one way or another has become absolutely indispensable. Others admit that this necessity is not to be disguised; but hesitate to advise the teaching of trades in the public schools as impractical. Of all the phases in which the question has been discussed, the latter is probably the one upon which the views of distinguished educators have differed the most; and while they express a unanimous opinion in favor of teaching industry, many claim that it ought not to be introduced into the elementary schools, because, they say, the subjects now taught fill all the time devoted to study, and it would be productive of no benefit to supplant any of them by industrial training, and that there

is no time to carry out such training without sacrificing some of the important branches of general education which would be more useful to the pupils than any little they might learn as apprentices. They also urge that, even if there were time without infringing upon other studies, what kind of trades would you select to be taught—should it be the plane, the file, the chisel, or the shuttle? And where would be the room for the bench, the lathe, the anvil, or the loom? Where can be found a master capable of teaching the use of these tools, and of many others? It is true, say these objectors, in case of necessity, the use of the spade and the rake might be introduced into rural schools; and of course the use of the needle should not be neglected in girls' schools, because, whatever their position, all women should become seamstresses for their own families. Another objection to the introduction of manual instruction into the elementary schools is its great cost. The necessary enlargement of the school, the tools and machines (to be renewed at every improvement), and the raw material (which would be lost if unskillfully made up), would be sources of enormous expense. These objections were urged before the French Imperial Commission to examine the technical schools of the empire; but they appear to have made but slight impression, and are now almost entirely forgotten in the brilliant success of the industrial schools which have been since established.

There is undoubtedly a very sincere conviction, expressed in a variety of ways, that although industrial education is highly important, there is yet considerable diversity of opinion whether it should hold a position in the public-school system. Even as powerful an advo-

cate of manual training as Mr. Stetson was induced to declare that the introduction of systematic manual labor into public schools appeared to be a thing of altogether doubtful expediency. He adds, however, that in apprentice-schools—schools attached to workshops and manufactures—as it is the leading object of these schools to teach practical application, systematic manual labor should, of course, form the leading feature of the instruction given. He concludes by observing that there can be no doubt that a certain amount of manual labor, especially if it shows the practical application of the theory which the student is acquiring, does not retard but decidedly promotes his progress in theoretical knowledge.

It is impossible, says Dr. White, who is at the head of a college of science and industry, for the public school to teach a tithe of its pupils the pursuits or occupations by which they are to earn a living; that of the one hundred and seventy-two occupations classed in the census of 1870 as manufactures and mechanical and mining industries, not a score can be taught in a school-shop; that the teaching of a few trades to all pupils would crowd those pursuits with workmen and reduce the compensation of skilled labor to the wages of common laborers, and would glut those occupations, and leave many skilled workmen without employment; and that the teaching of handicraft in the schools would give nine tenths of the pupils skill which they would never use in after-life, or use only incidentally; and much more to the same effect.

Recent examples should teach us to beware of objections such as these, when the prospects of industrial improvement are too abundant to lead us into speculative error. Such schools flourish in Europe, especially in those

countries where they are sustained at the public expense. While the United States has made greater provision for general instruction than any other nation, she is far behind all others in the successful prosecution of industrial education ; and it is singular that, in a country like this, which claims the glory of being the working-man's friend *par excellence*, it should do so much less for his industrial training than Austria or Russia, than Germany or Switzerland.

These are understood to be the leading objections, and it is believed they are stated in a form as near as possible to that in which they are expressed by those who entertain them. They deserve respectful attention, because they are the views of some of the most earnest friends of both general and industrial education. We are aware that these important considerations have been already canvassed successfully by men entitled to be heard, from their practical connection with the subject ; and the author will, therefore, content himself with stating some general observations only, that almost arise spontaneously in reply.

In regard to the great variety of mechanical pursuits and operations, and the expense that would be involved if manual training prevailed in the public schools, and that it would interfere with other studies deemed essential to a general education, let it be remembered that it is to form part of a system in which the training of the mind is to go hand in hand with general training in the rudiments of industry, including a knowledge of the mechanical principles underlying all trades, and a proficiency in the shaping and use of tools. The time of the children will be occupied in the ordinary kinds of lessons, but during

some portion of the school-hours they will work something in the manner of apprentices, but with this difference, that they will be instructed while at such work in the theory and principles of their work. In other words, they will acquire technical knowledge and practical manipulation to a degree high enough to enable them to find lucrative employment in some useful calling upon leaving school. The instruction should be limited at the outset, and be of the least expensive character; and no trade in particular will be taught, but the pupils will be made acquainted generally with the use of tools and machinery. In carpentry, for instance, there might be taught the use of the saw, the plane, and the lathe, in a shop costing little more than the materials for its construction; and perhaps, in many instances, in another part of the school-building itself. The processes for working in metal could be taught in a manner as inexpensive as those in wood, except casting. A steam-engine and some practical handling of tools and machines, two or three hours in the workshop twice a week, with a skilled workman for instructor, would make an excellent beginning.

Instruction in the use of tools is referred to by Mr. Philip Magnus in the following terms:

There is another subject of instruction which, having regard to the future occupations of the pupils, ought, in the opinion of many educational authorities, to be introduced into public elementary schools, viz, instruction in the use of the more ordinary tools found in every workshop. The advocates of this proposal do not desire that lessons in handicraft-work should occupy any part of the time that is now devoted to other subjects of instruction, neither do they suggest that such teaching should take the place of apprenticeship to any trade, nor do they ex-

pect even that it would sensibly diminish the period of such apprenticeship. They look to the disciplinary rather than to the directly useful influence of such teaching, and they recognize in it many distinct advantages. Following on the Kindergarten system of handicraft exercise, this instruction would help still further to train the hand to the perception of differences of size, form, roughness, and other qualities, which the sense of touch, guided by the muscular sense and sight, enable us to appreciate; and in this way it would serve as a real discipline and as a sense-exercise. Morally, it would teach children, at an early age, that there is nothing derogatory in hand-work. On the contrary, by making workshop teaching a part of the school-instruction, the pupil would be trained to recognize the dignity of labor, and would come to understand that it is as honorable to earn one's living by the use of the file as of the pen. M. Jules Ferry, in laying the foundation-stone of a professional school at Vierzon, one day this month (1881), is reported to have said: "Caste-ideas would vanish when tools were found in schools alongside of maps and books; the nobleness of manual labor would be perceived, and concord would be spread."

In pursuance of this same idea, let us also remember that many of the useful arts are ruled not only by similar principles, but by mechanical apparatus of analogous power and mode of operation. This is practically exemplified by the use of the lathe in turning, whether in wood or iron, or by hand or steam-power; and "so in fitting it always depends upon a correct eye and manual skill; and the individual who can fit a piece of iron by means of the file will soon fit a piece of wood with the aid of plane and chisel." Attention should undoubtedly be employed to press as many of these general mechanical movements as possible into the method of instruction, in order to obtain a good execution in manual operations which resem-

ble each other in different trades. Mechanical philosophy teaches that all the simple mechanical powers are six in number; namely, the lever, wheel and axle, pulley, wedge, inclined plane, and screw; and that these simple powers are so adjusted as to produce all the movements and combinations in all the vast variety of intricate machinery which men have invented and constructed.* What is true of these simple powers applies with the same force to the tools which men usually employ in their labor. It is therefore contended that a true and full knowledge of these simple powers, and a rudimentary acquaintance with tools in a general way, would be just the kind of information to enable the pupils to achieve their place in society and maintain successfully the battle of life. Instructions even of this elementary character in the practice of manual industry would have changed the conditions of tens of thousands in our cities, who have not the skill or ability to work, and who consequently become the mere parasites of society.

There is no great mystery about the trades. They are much easier acquired, and almost in a shorter space of time, than it takes to learn the game of chess. They are all ready made. The machines and tools are invented; and if a young man understands how to use and how to construct them, but a very short time will be sufficient to make him a good workman, and he can turn his hand to any trade he likes best, without wearying himself out in the repulsive drudgery of a long apprenticeship. The delicate touch and the dexterous hand will come with practice and experience; and he will execute and measure his work with the fine inspiration of its philosophy and

* Comstock, "Philosophy," p. 98.

ingenuity. In the present organization of our industries, there is no danger that the trades will become glutted, and that the standard of wages will be reduced by the competition of skilled workers, for, with intelligence in the head and the hand of labor, occupations will multiply with every step of human advancement. The fountain of industrial art is inexhaustible. The resistless and matchless progress of science is always giving out something more to learn and something more to do, and there is no limit to improvement. Think of the ample opportunities for work that spring almost every day from the increasing knowledge of electric light and motors, from electro-magnetism and electrotpe, the telegraph, the telephone, and other developments. Scarcely a day passes without the announcement of a new process or principle in nature. Skilled employments are in their infancy. Applied science and human ingenuity are ever elaborating from the magazines of Nature new forces, unknown but yesterday, and furnishing illimitable prospects for human industry. And, in the face of all this increasing demand, American workmen are scarcer every year. The tendency is toward the genteel pursuits that are crammed with young men who can do nothing, and the want of industrial skill is such that this process is likely to go on. Every country in Europe sends its floods of skilled labor to take their places and "reduce wages" with a vengeance, and at the same time reducing our own children to idleness and its train of evils. The affected anxiety of those who are fearful that industrial teaching in the public schools would crowd any particular trade, is evidently neither pertinent nor reasonable. It is altogether too remote a probability, and the alternative now presented is,

whether we shall adhere to the existing system of idleness and want, and the misery and crime which inevitably result, to the exclusion of a beneficent fabric of practical education and its attendant blessings of wealth, skill, and prosperity. Does it not seem like taxing our patience to reflect further on these objections? But let us proceed. The country is full of people who live on others' labor, principally because they know nothing of honest work; and we are not left to speculate upon their debasement. Idleness is their scheme of life. One of the best means of eliminating this element would be the complementary training of mind and hand, to fit them for their duties to society, and so develop their natural capacity, by even a few months of rudimentary instruction in the practice of tools and machinery. Where we have sown in neglect, we must expect to reap the consequences.

It is seen that the plan of manual training does not contemplate the erection of huge workshops filled with the finest and most expensive machinery, in the first instance; or to secure as instructors the greatest mechanical artists of the age; or to teach all the different kinds of trade in a special manner, and perhaps no trade at all in particular. But to teach those branches which will be auxiliary to all practical labor, under instructors of the ordinary school, and a part of the time by specialists, skilled artisans, engineers, and manufacturers, in shops suited to the practice, and at such hours as will not interfere with the school-room or its general studies. The local circumstances of the school are also to be considered. It is to be co-ordinate, and equally entitled to its hours of instruction. The subjects to be taught must be carefully considered, and no doubt much will depend upon the arts

and industries of the place and the coexistence of similar institutions. Much excellent work can be accomplished without disgusting the children, or expecting them to become ideal artisans. Moderate instructions can be provided at the outset, and such as will complement the other studies of the pupil by showing their intimate relation. Study and work will go hand in hand in honorable companionship, and drawing, mechanics, mathematics, and design will be wrought out in the different objects upon which the hand of labor is employed. And when it is seen that intuition is blind until the hand has made it a fact, and that ideas are void until they are embodied in some potential form through the trained perfections of man's physical powers, the pupils will be imbued with a personal and disinterested appreciation of the worth and dignity of labor.

Technical instruction and hand-work with tools and machines, of a general character, will prepare the pupils for a very great variety of trades, especially in the mechanic arts. Mr. Leland's industrial school for hand-training in the minor arts gives a sufficient preparation to enable those attending his classes to practice efficiently in fifty or a hundred of those arts after a few days' application, and he also observes that all branches of industry allied to ornament are very easy, and can generally be so far mastered in a day by anybody who can draw as to enable him to produce a perfectly satisfactory result. The same is undoubtedly true of industrial art generally; for if, in addition to a knowledge of drawing and design, a young man is also scientifically instructed in the use of tools and in the action of machinery, it can require not more than a few days or weeks at the most to fit him in the com-

pletest manner for any branch of industry in the mechanic arts. There are several trades which might require a special training, and for which special schools could be provided in the course of time; for let us remember that institutions grow. There is no more striking example of this adage than the contrast presented by the splendid condition of the common schools, and the period when the teachers boarded round among the parents of the pupils. A community of skilled workmen cannot be built up in a day; the foundation must be laid in technical training and in the gradual process of experience and invention. And this requires much time, but it affords the best support of the state, because it administers to the welfare and comfort of all other classes, especially in a country going so fast in the direction of commerce and the productive arts. It may be said of such a community, as was sung by Goldsmith concerning the rural population of his own land:

Ill fares the land, to hastening ills a prey,
Where wealth accumulates and men decay;
Princes and lords may flourish, or may fade;
A breath can make them, as a breath has made;
But a bold peasantry, their country's pride,
When once destroyed, can never be supplied.

Just here it would not be amiss again to notice the success which attends industrial schools established by law in Belgium, Germany, France, and Switzerland, in educating the people who are to live by their brains through the work of their hands. In Mr. Stetson's book on technical education is a statement of the testimony of M. Rossat, Doctor of Science, and head-master of an industrial school at Charleville, France, before the Imperial

Commission, who testifies substantially that the practical are in no way injurious to the theoretical studies; on the contrary, in the subjects of descriptive geometry and industrial drawing, manual labor seems to stimulate the pupils. He states that in his school practical work in the shops and laboratory occupies two hours a day, and that the pupils beg that the time be extended. Many of them possess great skill. The shops and all the works are under the direction of a civil engineer, and under him are three foremen—one in the fitting, another in the smith's, and a third in the carpenter's shop. The proceeds of the labor of the pupils, if any, go toward the maintenance of the workshops. In the fitting-shop, the most skillful pupils are occupied in putting together a steam-engine to drive the machinery; others are making models and parts of machinery. There are thirty carpenters and fifty smiths, besides the pupils who are occupied with manipulations in the laboratory.

This description applies more particularly to the industrial school where trades are taught, and will answer for hundreds of others in the countries named. I select it for the purpose of demonstrating by an eminent example that the mental and physical powers relating to skill may be concurrently educated with advantage to both, and without realizing any of the fearful evils prognosticated by our American objectors. If it be said that this would not apply to elementary schools, I appeal to those of France, where it does.

It appears from the report of the Royal Commissioners on Technical Instruction, mentioned in the last chapter, that the ordinary curriculum of instruction in the French elementary schools comprises reading, writing, arithmetic,

grammar, geography, the history of France, drawing, and music, and it is strictly carried out in all the large towns; but they add that instruction in manual work has of late been introduced into a considerable number of these schools in Paris. The manual instruction begins at the age of ten years, and for the present is optional, and is given before and after the usual school-hours. At the time the commission visited Paris there were twenty-three primary schools to which workshops had been attached, ten others were on the point of being opened, and preparations were being made for attaching workshops to twelve others. The rooms for instruction in drawing and the workshops in these schools are well ventilated and lighted. Special inspectors determine the quantity of work to be done, and judge of its quality.

The municipal authorities of several other towns were giving a favorable consideration to the introduction of manual labor into the ordinary elementary schools, after the example of Paris; and at Rennes and Marseilles arrangements had been made for teaching manual work in their elementary schools.

There has been but one elementary school in Paris in which complete trade-teaching is combined with ordinary instruction. This is the communal school of the Rue Tournefort. There are three hundred and sixty children in the school. Trade-instruction commences at the age of ten years, and continues for three years. In the third year the work is specialized, some of the children being taught modeling and carving; others, joiner's work and cabinet-making; others, again, forging and fitting. In the highest class they have eighteen hours per week in the shops, besides instruction in drawing, geometry, and natural sci-

ence. The children on leaving school are generally prepared to practice a trade, and find ready employment. So strongly are the pupils interested, that technical workshops have been fitted up in many others of the Paris schools during the holidays, to enable the pupils on leaving to become skilled workmen after a short apprenticeship.

The manual instruction thus introduced into elementary schools is confined to advanced drawing from models, and the use of the ordinary tools in working wood and metal, without attempting to teach special trades. They are therefore not to be confounded with the apprenticeship-schools proper, of which that of La Valette is the type; or like the great school at Creuzot, to form skilled workmen for the business firm by which it has been established; or like the watch-makers' school in Paris, designed for a particular manufacture. In this connection, we ought not to overlook recent legislation in France relating to handicraft in elementary schools. The first article of the law of 1880 places apprenticeship-schools in the category of primary instruction. A commission appointed to prepare a programme of instruction conformable to the provisions of the act, considered that teaching particular trades should be avoided in the primary schools, but recommended a series of manual exercises intended to develop the children's skill of hand—such as object-lessons, drawing, modeling, and the characteristics of wood and the common metals; and upon reaching the upper class, at the age of twelve, in addition to these exercises, the pupils should study, two hours per day, various tools used in working wood, and the construction of articles in that material, making the lessons both practical and theoretic.

cal ; also the study of tools used in working metals in the same manner, with exercising in filing, smoothing, and finishing rough forgings or castings. The practical work is carried on in shops annexed to the schools, and is well calculated to discover the special aptitude of the pupil for the work for which he is best fitted, whether requiring precision or taste, or for trades dependent upon mathematical knowledge, and, if not gifted with such excellences, whether he can perform useful work requiring less ability.

After the primary, comes the apprenticeship-school proper, in which it is proposed only to teach the parent-industries, or those which resemble each other in the tools they employ and the mechanical principles they involve. The superior primary school is the last of the series for technological education of a high order.

Thus we see that France felt itself under the same necessity as its neighbors to make the utmost exertion to preserve its useful arts, and to increase their number to the greatest extent possible. Almost every trade was suffering from the inevitable decay of the old system of learning it. The following is the tenor of a passage from the report of H. Tolman, senator, to the Prefect of the Seine :

Again, the workshops where private industries are conducted no longer, except in a few rare instances, adopt the system of a true apprenticeship. The majority of manufacturers have given up taking apprentices ; the lads they employ are set to a special class of work, often of the most insignificant kind, receive remuneration from the first, and, by mutual consent of the parents and employer, the contract of apprenticeship is abandoned for one of hire.

A revolution of this nature in the methods of production threatens above all the prosperity of French industry, and more particularly the welfare of that of Paris.

Now, it is more particularly in the parent-industries, comprising various trades or specialties having numerous points of resemblance, the work in which is of a similar character and renders necessary, to a great extent, the same class of tools, that the system of apprenticeship is gradually disappearing, while employers are powerless to remedy the evil, however sincere may be their desire to do so. For these great industries, the only means of raising the standard of technical knowledge is the establishment of apprenticeship-schools.

Animated with a desire to avert a condition so ruinous to the moral and material interests of the people, the city of Paris and the Government of France have resorted to the policy of industrial education, as altogether the best remedy which experience and practical results have yet devised. Opinions to the same effect have been formed on this side of the Atlantic by many persons who are fully competent to form an opinion from having devoted themselves with the greatest attention to this question. Take, for example, the conclusions of the Boston School Committee, perhaps the most distinguished authority on educational questions in the United States, and who report that they believe industrial training, or the training of the hand and eye, and thereby the mind as well, is an invaluable element of education, and deserves recognition and support; and, while they express an opinion adverse to teaching actual trades in elementary schools in a complete manner or extent, still they recommend teaching the minor arts as in the industrial schools in Cambridge, Gloucester, and Boston, wherein it is proved

that courses in industrial training may be devised suited for different ages, and that such training might begin in the primary schools, and be continued in the grammar-schools, possibly even further, to correspond with the literary training given in the high-schools. As to whether the proposed industrial training would interfere with the other studies, they quote an authority on the "half-time" system of education, which says, "There is a special mutual influence between the school and the factory which improves the quality of the work done in both." And, in conclusion, the committee express a feeling in favor of introducing into the public school ample and fundamental industrial training, for they believe that such training is an invaluable element of education, suited to develop and help all, whatever their future career.

These views are of momentous importance. They come from the commercial and industrial emporium of that part of the country which is most interested in the subject, and they recognize the want of industrial training which now exists and oppresses industry, but they also recognize the necessity and feasibility of introducing it as a fundamental element in public instruction.

Mr. Edward T. Steel, President of the Board of Public Education for the City of Philadelphia, in his annual report of 1881, is not less emphatic in his devotion to industrial education. In his opinion, manual and intellectual education should be regarded as equally necessary to the welfare and safety of the state, and should command equal opportunity of acquisition; and it seems more essential to him that the knowledge of a trade or occupation should be acquired before arriving at manhood, for intellectual training may cover every period of a lifetime.

He holds that there is no kind of ignorance more to be feared by our social and political institutions than that which knows no handicraft or special occupation upon which it may depend for the necessities of life. When illiteracy is joined with untutored hands, a type of humanity is reached more dangerous than the uncivilized subjects of barbarous tribes. He alludes to the public disorders, when recently the most desperate and reckless of that class assailed the business enterprises of the country ; and to the fact that few of those who composed the alarming mobs had any knowledge of skilled employment, when it is equally true that during that season of business stagnation, as a rule, the regular trades and skilled occupations afforded a fair living support. The fact, he says, is becoming better understood that, unless education embraces manual as well as mental training, it will fail for want of thoroughness, and that, when the intellectual attainments which properly belong to the trades are made to lead into them, they will rank first among the occupations as practical results due to the above theories and principles.

These observations come from the right quarter, for the growth and riches of Philadelphia depend almost entirely upon her varied and numerous industries. She has become great and populous from the spoils of labor. There was a fitness in her owning the first school of art-industry established in any American city—that already adverted to in the Hollingsworth Building—which has seized upon public favor, and is becoming identified with the needs and tendencies of her useful arts. Without doubt its influence will be great, for it will lead to similar institutions, as the living representation of its industry.

CHAPTER XIV.

Application of experience—Speculative improvement tardy—Franklin's discovery not applied for one hundred years—Industrial education in the United States rendered simple—Classification of industrial schools into three kinds—Each described—The developing plan of Ruggles—The one for teaching mechanic art recommended, and the reasons stated—Public education a fundamental maxim—It ought to be for the greatest number—Manual training in public schools—Law in Massachusetts—The great body of the people employed—Education should, therefore, form an ability for the business of life—Intellectual training at the expense of manual and social virtue—Division of labor, and development of art—The children and their employment—Mr. MacAlister's address—Inexpensiveness of industrial education shown—Absolute necessity of manual training—Education at public expense—Reliance on the state—Form of government depends upon people—How children are taught—In an ignorant society man becomes debased—Education should be for useful purpose—Multiplicity of employments, and the inducement to self-perfection—Training the great mass of workers a matter of life or death—Illustrations—Its proper place allotted it—Richard Grant White—Special trades not favored in public schools—Working-people not opposed to the manual element in education—The reason why they should not be unfriendly to it—Spring Garden Institute—Examples of working-men receiving instruction—Night-schools attended by working-people for studies relating to industry—Encouragement from extensive firms and corporations illustrated by an example—Opportunities for industrial education—Industrial establishments willing to aid—Object of industrial education—Wendell Phillips—Lord Brougham's remark—Professor Smith's views—Views of the Boston School Committee—Expenditure in the *École municipale d'Apprentis*—Effect on Paris—Graduates of our schools—Professor Runkle's views—Mechanic art of wide application—Confers mental discipline and increases the mental powers.

I HAVE thus glanced at the experience of this and other countries, to show that theoretical views on this sub-

ject have been practically illustrated in a great variety of examples. Induction is an application of recognized facts of greater or less generality. A mere logical demonstration of a question has a charm for the mind because it is so satisfactory, but an experimental verification fills both the mind and the senses with a living proof which surpasses simple reason or logic, because it involves the facts of sensibility as well as those of intelligence. When we rely solely upon the speculative powers of the mind, improvements creep tardily along, notwithstanding man's ingenuity or necessities. It was not until the lapse of one hundred years after Franklin had discovered the perfect conductivity of the electric fluid that a galvanic current was found to transmit signals at a distance. The best method of practical wisdom is to profit by the experience of others, and industrial education in the United States is rendered a problem much more simple by the comparative ease with which it has been introduced into public schools elsewhere, and by the gratifying results which have attended it: they go far to overthrow the objections set down against its practicability.

Industrial schools ought to be distinguished into three kinds or classes, according to the object for which they are intended:

First. If instruction is to be given with reference to a particular trade or trades, the studies should be special, and such as belong to an apprenticeship proper. There are a number of such schools abroad, but it is doubted whether there is one of this kind in the United States, unless in the Indian schools at Hampton and Carlisle.

Second, is the art-industry school, or such as give instruction in art as applied to industry. This is more espe-

cially devoted to drawing, designing, modeling, and the natural sciences. These promote the general culture of the people, and improve manufactures by making them artistic and salable. Within a few years the economic value of such schools has been a marked feature in British industry, and has remedied imperfections in every branch of useful art.

Third and lastly come those which are not special, but prepare the pupils for work generally, according to their ability and inclination, throughout the entire industrial field. Here they are taught in the principles of mechanism and in the tools commonly used in all the trades. Perhaps it is difficult to define what constitutes an industrial education of this last kind in a public school; but one may state, in a general way, that it means a school apart from the ordinary one, where all things bearing upon industrial pursuits are taught. This includes the properties of bodies, the rudiments of natural philosophy, drawing, and design. There must also be shops where technical knowledge is acquired by practical instruction with machinery and tools, beginning with the easiest and least expensive, and enlarging the work until all the leading principles and employments in what Senator Tolain so aptly terms the parent-industries have been generalized in the course of instruction. The pupil, when this is done, can turn to any kind of business for which he is most fitted, and a very few days will be sufficient to specialize his work in any of the ordinary trades of a mechanic. We are learning experience in the practical working of this class of school by what we have noticed in Philadelphia, Montclair, Washington, and elsewhere, for there we find industrial schools, if not in name at least in

reality ; and they show that these studies are suited to children of twelve years and upward, and even excite their zeal and devotion in the work. The theorists who call for specialists will be disappointed, because an artisan of a particular trade is not turned out. This is not the plan of the school. It professes to furnish the pupil only with such general knowledge as will give him the key to all his abilities in any department of work where he can labor the best. The industrial field is before him ; nor will he hold the tenure of his pursuit by the thread of a single accomplishment which interdicts him from all other vocations. On the contrary, he can exercise the essential skill of many employments, and may improve the one to which he devotes himself by reason of his technic information. There is little danger that he will ever present the unedifying spectacle of a toady, a Bohemian, or an impecunious journeyman. It is believed that this third kind of school has many distinguishing merits. It has the great advantage of superiority in point of simplicity, and of facility in general arrangement in practical operations, and is probably the form best adapted for manual training in the public schools of the United States.

It is proper here to notice the Developing school and the Manual Institute suggested by Mr. S. P. Ruggles, which have attracted the favorable attention of the American Social Science Association. The first of these is a fully equipped school-shop in which the pupil is to acquire an accurate knowledge of the principles and operations of all trades, by means of which practice his peculiar aptitudes will be developed, and he can then be well advised of the profession for which he is best suited. After this, the pupil is to enter the Manual Institute,

where he will be instructed in his chosen occupation in the most effectual and profitable manner. The first of these is only a beginning to lead the pupil to understand himself, and to give a right direction to his choice of a profession; then the Manual Institute combines with this a special training of all his faculties in acquiring that particular trade.*

* The developing school is described by Mr. Ruggles, the originator, as follows:

"Imagine, if you please, one very large room, with a steam-engine and boiler in the middle of it, so that all pupils that have any taste for the management of steam, or steam-engines, could examine every point, and readily understand it. Then a carpenter's bench, with a variety of tools, to show how that work is done; then, perhaps, turning-lathes, to show how the wood-turning business is performed; then, with the aid of black-boards and carving-tools, it might be seen how drawing is done. We should also have planing-machines, lathes, upright drills, jig-saws, etc., to represent the machinist business. Foundry-work could be shown by having the usual fixtures for sand, and two and three part flasks for molding; the casting could be done in soft metals, as lead, zinc, or tin, which could be re-used, as the whole art in foundry-work consists in the different modes of molding. We would have a printing-press, type, and fixtures, to illustrate the printing business.

"Mason-work, the laying of brick (to some extent), stucco-work, the working in plaster of Paris, could be shown; the whole room being filled with educational instruments of instruction, such as three different heights of barometers, the bellows-valve, the gyroscope, the ball on the top of a jet of water, the steam-injector—all to lead out the thoughts of the pupil, enabling the superintendent to ascertain the true bent or natural genius of the youth, so that he should be sent to the right department in the Manual Institute, and thoroughly instructed in his chosen art."

The Manual Institute is mentioned in these terms by him:

"As soon as it should be ascertained by the Developing school for what kind of business the pupil is best fitted, he would be sent to the Manual Institute where his chosen trade was taught, and be more thoroughly instructed in two years' daily instruction than by six or seven years under the old apprentice system.

"A machine-shop in the Manual Institute, fitted up for the purpose of

Having thus stated the different forms of industrial schools which seem to have any claim to consideration, the question occurs, which one of them would be most suitable for general use in our public schools. It is claimed that the last one of the three classified above has several advantages for that purpose. It seems quite clear that the choice ought to fall on that one, or on the plan suggested by Mr. Ruggles. A careful comparison will show, I think, that, while the latter has great intrinsic value, the former has the merit of simplicity, inexpensiveness, and organization. These are considerations of no small importance with those who are willing to promote industrial education, but do not deem it prudent or expedient greatly to increase the public burden, already so great. It is obvious that two schools, as contemplated in the developing plan, would double the cost and expense, or at least increase them to such a degree as to render it appalling to the constituency. It is too institutional and cumbersome for a beginning. In the other school the same ends will be secured, for the leading principles of business will be carefully pursued and

teaching a trade, would contain every tool and appliance that is used in any machine-shop, so that the student would become acquainted with every manner of doing work, and with the management of every kind of tool or device used in machine-shops, doing every variety of machine-work; and each pupil would be taught to make the whole, and put together every machine or article that was manufactured.

"In the Manual Institute the pupil would advance from a lower degree of instruction to a higher as rapidly as his thorough knowledge and good workmanship would justify. The instructors would be paid a satisfactory salary, and not be permitted to make merchandise of the *time of the students*. All articles made by the students could be disposed of by sale, and the proceeds appropriated toward defraying the expenses of the *SCHOOL-SHOPS*."

wrought into the understanding by familiar illustrations and repeated exercises, and the eye and hand trained to habits of accuracy and skillful manipulation, until it will require but little reflection to discern the peculiar bent of the pupil's genius, and the profession most appropriate for his abilities. This will save a world of expense, of labor and inconvenience, and at the same time will be fully sufficient to qualify him to enter upon his business with the best possible means of success. While the developing plan is fuller in its preliminary exercises, these are soon specialized to a particular calling; the other is far superior in its economy of time and means, and in that fullness and generality which characterize its arrangement in teaching all the principles and operations analogous to each other in mechanic art. Surely the pupils would have a better chance in life than if they were only accomplished in one direction.

I have incidentally remarked upon the duty of the State to establish and maintain schools for industrial education by appropriations of public revenue. It seems desirable to advert to the subject again in order that the legal status of such schools may be fairly understood. That the public ought to provide for the education of the people is a fundamental maxim in this country. It is confirmed in numerous State Constitutions, and is consecrated in our jurisprudence. The general principle being settled, the question is asked, What kind of education ought to be provided, and how far ought it to go in improving the children? The answer is obvious. It ought to be for the greatest number, and to consist of such branches of study as can be applied for some practical and useful purpose in the life to which the pupil is

destined, and in the duties of a citizen to which the law invites him. It is safe to say that this is scarcely supplied by what is now understood to be a common-school education ; and it is for the voters in the cities and school districts to determine whether the instruction afforded to their children may not be varied and extended to branches of knowledge of a practical and manual character. Unless the Legislature has restricted the studies to be taught, the people through the school boards or trustees have a right to furnish manual training to all the youth in the schools, or at least to put it within the reach of all classes who may desire it. In Massachusetts, the amendments to laws relating to public schools authorize the city council of any city and any town to establish and maintain one or more industrial schools, and to raise and appropriate the money necessary to render them efficient ; and, no doubt, the Legislatures of other States would feel bound to conform to any popular demand for similar enactments. The present appears to be the opportune moment to call public attention, which is already aroused, more particularly to the subject, since industry is in a transition state, and some means must be devised by which it can be taught in view of present conditions and future prospects.

The great body of the people have to spend most of their lives in the exercise of some employment. The number of those who can exist without work is inconsiderable. Aside from the common laborers, all the others become artisans, manufacturers, merchants, farmers, or flock into the professions. Education should, therefore, be directed to form in them the ability and knowledge which their business life requires, or at least to such an

extent as the art of teaching will admit of. It should render them capable of exerting their intelligence and training in the situation they are to occupy. The lawyer, the physician, and the engineer gain instant assistance from their studies, but the school-boy reaps scarcely a personal advantage, for the training of his intellectual powers has been carried on at the expense of his manual and social virtues ; and on leaving school he runs to and fro, seeking something or anything to do, scarcely a self-existent being.

The prodigious development in the useful arts has introduced a division of labor almost endless in its variety, with an infinity of occupations, and such as require an extraordinary degree of technic knowledge in both the hands and the head ; and the improvement of all manufactured articles has undergone a surprising development in every country with which we have extended commercial relations. The rude system of apprenticeship has been superseded by technical training. What are you going to do with the children ? Their parents are generally poor, and have not much time or means to spare for their education. And, perhaps, in nine cases out of ten, they can but illy provide for their subsistence during infancy. You say, send them to a trade, which many of them would gladly do, but for the difficulty if not impossibility in the present state of things in finding one. Says Mr. MacAlister, in the address already mentioned : "Stand on Central Bridge, in the city of Milwaukee, at six o'clock in the evening, and see the thousands and thousands, not only of boys, but also of little girls, with their baskets in their hands, going home from their day's work. They left their humble homes at six o'clock in the morning ; they

had their luncheon with them, and at six o'clock they are on their way home. They have had all the education their parents could afford to give them." And he adds that this ideal form of education will not do, after all, for the demands of the present time. Why, then, let us ask, not give them an opportunity to acquire, or at least to fit themselves for afterward acquiring, the trade or profession by which they are to support themselves? For a very small expense the public can facilitate and afford to the whole body of the people the means of acquiring the most essential parts of an industrial education. Do you ask what interest can the State have in furnishing to every child instruction that will enable him to follow a trade? Labor is the fundamental condition of society and the fountain of its intelligence and wealth. But perhaps the best answer is to be found in the condition of our industries, which can no longer prosper without the aid of science and art. Manual training is necessary in order to prevent them from falling into the hands of foreigners, or their entire degeneration in our own unskilled management; and it is now recognized and maintained in every civilized society as a most vital and important branch of public education.

"The people have learned that industrial training of their children is the fountain of their prosperity, and prefer elementary schools to prisons, and trade and technical schools to workhouses and emigration, and school-rates to poor-rates." If the right of the State to suppress idleness as it does ignorance, and to afford a real education as it does an ideal one, is denied, then there is small hope that that work will ever be maintained by private enterprise. No system of education for the body of the peo-

ple has ever been able to exist except at the public expense. The educational aptitude and strenuous industry of the American people have been paid for by taxation. The States have made the general laws, and local boards have prescribed the studies and raised the means. It is in vain to expect a system of industrial education unless either the State or the locality shall bear the expense. Even in a country so remarkable for its general benevolence as the United States, where thousands of individuals devote their time and money to relieve distress, is it not to be wondered at that this philanthropy, which embraces every form of charity, has done so little to promote industrial education, although it is founded in the intellectual, the moral, and physical worth of our nature?

It is said that, when everything is expected from the State, the temptation is very strong to demand from it the realization of all the hopes founded upon its "omnipotent action"; and that self-reliance and a feeling of independence, which produce all that is good and noble, are never so well assured as when each person counts least upon the Government. These are among the general opinions which in this country we all accept, and yet we must all acknowledge that no one influence prepares each character for an intense and vigorous individuality better than the education we ought to receive; and, when this education is suited to the condition and wants of the people, they become independent beings, perfectly able to take care of themselves. Children cannot be made the bases of a system of individualism.

The form of government depends upon the amount of knowledge which the people have acquired. An ignorant man is incapable of a form of government based up-

on intelligence, for it is not suited to his condition. But, as he grows in knowledge, he needs less and less the control of law, until he is sufficiently advanced to enjoy institutions which impose the least possible restraint upon his freedom and independence. He then displays that refinement and intrepidity which we contemplate with unspeakable sympathies. Education is now carried by votes of popular suffrage, and is connected with the Government as the most immensely important institution under its care. Here the child is taught. He is helpless, and has everything to learn. He believes what he is told, and obeys without being able to exercise his own reason; but as the bud contains within itself all that constitutes the fruit, so does he all that belongs to man. If, however, he is permitted to grow up into a man without instruction, the most groveling and debasing tendencies will be likely to sway the whole course of his life. In a society where ignorance prevails one man differs but little from another; there can be but a limited stock of ideas to kindle their intelligence; each one spends his time in performing the drudgery of his station, and is as incapable of appreciating the communication of knowledge as he is of feeling any noble sentiment or aspiration. He becomes as little like a man as possible, and subsides into stoical indifference and stupid inactivity, or pales and trembles in mortal fear and superstition. Education is therefore dependent upon the State, which is bound to see that it is provided for every child that it can reach. It exerts an influence beyond the mere discipline of the school-room, in the elevation of life and character, and develops the peculiar characteristics and brightness of the individual.

I take it that every part of that education should tend

to some useful purpose, and, as nearly all of the pupils will be compelled to earn a living, it should improve the faculty which will render them able to meet this supreme necessity, and teach those branches of knowledge in which they have the deepest interest. In the great multiplicity of employments, and the sharp competition which they engender, every workman is called upon to exert his capacity to open up new views of his art, and thus contribute to the progress of his industry. Invention is on the alert, and every man has the strongest inducements to self-perfection. The artisan is no longer expected to fall into the dull routine of mere mechanical action. He is engaged in a contest where energy and skill will carry off the prizes, and where the unskilled and untrained workman will pay for his deficiencies by a sacrifice of all those comforts and improvements which are the reward of intelligent labor. No artisan can acquire this improved understanding without a technical training which very few now possess. Practical life includes education, and the latter should respond with everything that life calls for. We want a training that will reach the great mass of workers. This is a matter of life and death. We do not want any more cheap workmen, for they are by far the most expensive in the end. Education must be based upon the physical laws of our organization as on our mental. Only half educate a man, and he is unbalanced. It is like setting a man to walk on one leg, or requiring a carpenter to work evenly without using the plumb-line, the water-level, or the square. Equilibrium is the foundation of what we technically term industrial education, which is exactly the counterpart of intellectual culture. It is the equitable adjustment of our various faculties, the one

giving strength and skill, and the other wisdom, refinement, and ingenuity. It is a balance of ideas and dexterity, of ability to suit the action to the thought; the alliance of mental and muscular devotion, in which industry shares in what has been the exclusive empire of literary instruction.

It is evident that in this new order of teaching there should be due proportion of time allotted to each branch, in order to form a harmonious whole. The children must attend the industrial studies uninterruptedly, for they are progressive and in dependent connection. They can have no elective choice, as the basis of the system is to generalize instruction so as to embrace mechanical tools and operations common to as many trades as possible, and children of twelve and fourteen are generally incapable of specializing their own pursuits. The negligence of parents and the idleness of scholars are not to be encouraged, for the want of discipline in such a school would be fatal to the whole plan.

Richard Grant White, whose peculiar views in regard to our public schools do not recommend his suggestions to the friends of education, has expressed, however, some views on this subject that are worthy of serious reflection. He says :

There seems to be no other method conjecturable than the establishment of public workshops, which shall be public schools of the various trades or crafts, into which boys and girls might be received under conditions something like apprenticeship. For, obviously, it would be impossible to allow attendance at these trade-schools to depend on the caprice of the children or even of their parents. Without steadiness and continuity of attendance on the part of those who sought their benefit, these trade-

schools would soon fall to pieces. This is one of many difficulties which would be found in the way of the establishment of such a system. Another would be the hostility of the trades-unions. For, in the first place, such a system would multiply the number of skilled artisans; and in the next the work of the public apprentices would, of course, be sold; and for both these reasons all the trades-unions would make common cause against them. None the less, however, the question must be met and solved. The French, most logical, most practical, most thrifty of peoples, of all peoples the richest and apparently the happiest, have undertaken the solution of this question in ways to which I may refer hereafter.

Public schools devoted to teaching special trades are not regarded with favor by those who appear to have given the greatest reflection to the subject, at least in the present situation of things; but it is somewhat remarkable that the writer anticipates the hostility of the very class that is to be benefited by manual training in public workshops. His expectations are quite likely mistaken, and perhaps the introduction of the manual element in a general way would obviate the objection. Those who can read and write might with equal consistency oppose giving instruction in those branches to all others, and demand that ignorance should not be educated, for fear that an insignificant fraction should lose the benefit which knowledge in these arts conferred upon them. The artisan fears competition, but surely he cannot object to have his own children instructed in the means of gaining a living by the work of their hands, instead of knowing no employment, and thus draining European countries of skilled workmen to take the places they ought to fill for their own support. No class should take so much interest in

technical or manual training as working-men, for their prosperity depends upon it, and in this period of high workmanship it is the only means which can enable the American artisan to hold his own in the fierce competition to which all trades are subjected.

It has been found that workmen are ready to avail themselves of any means of instruction connected with their particular handicraft. The report of the Spring Garden Institute is very significant on this point. Very nearly one half of the entered pupils in the industrial classes are young men engaged during the day in mechanical employments, where they feel the need of such instruction as the school affords. "They do not come for idle amusement but to work, and they *pay for the privilege* out of their own pockets, demonstrating their good sense, and the failure of shop practice, as it exists to-day, to meet the needs of learners." The same effect has been observed in the English and Massachusetts night-classes. Take, for instance, the answer of a working-man to a series of questions propounded to working-men for an expression of opinion upon the effect of education on the productiveness of labor in 1872, which reads as follows: "I knew three young men in this place, inside of the past four years, that took instruction in drawing machinery, *while working at their trade*, and since then have taken out patents. One of them is now manufacturing an invention he patented, the American governor. I could enumerate numerous instances of the same kind that have come under my observation since working at my trade."

Another example occurs in the special report of the Bureau of Education, just issued (1883), where it is stated that a mechanic in New York city, who had accomplished

so much in his trade as to have received a medal at the Paris Exposition of 1878, in a recent letter to that office refers to the starting-point in his career as a thinking and educated workman as follows :

After serving my apprenticeship and working three years as a journeyman smith, I began to feel how ignorant I was, and how much I stood in need of culture and other matters which could only be gained through an education. And, to lift myself out of this mediocre mine in which I had so long remained, I attended night-school twenty-eight nights at one of the public schools of this city, at which I mastered reading, writing, arithmetic, and book-keeping, single and double entry. Since that time I have been an ardent student.

Besides furnishing a valuable and interesting account of various industrial institutions, the same report also gives the statistics of industrial work in evening-schools which have been established in a great many of our cities. Many of the studies relate to industrial subjects though not to special trades, such as drawing, designing, modeling, and mathematics. These schools are usually attended by the children of working-people, and by young mechanics, in order to acquire that knowledge which they deem desirable and even necessary to enable them to pursue their various vocations with skill and intelligence, and which cannot be acquired in workshop practice. Almost every industry is represented in these classes, notwithstanding the inconvenience of attending them after long hours and hard labor during the day. The report remarks that doubtless many have not strength to labor and study at the same time. Yet it may be assumed that the cases of injury from overstudy at night are fewer than

the instances of moral and physical injury received in evening hours upon the street or in the haunts of vice. When at length a pupil is found who possesses strength and ability to combine faithful and efficient work during the day with intelligent study at night, he is worthy of higher education. He has passed a test that would have shown serious obstacles to progress in his trade, and enables his superiors to forecast the probabilities of his final success. He has acquired a practical knowledge of the matters which his technical studies would explain and illustrate, and thereby can pursue them to the best advantage.

Now I apprehend that men and children who sacrifice so much to enjoy the advantage of technical training which these schools place within their reach, will not object to a still more practical system of education, during the period of youth, for all. Employers ought to appreciate the important bearing of the subject, and encourage and support every measure for perfecting their workmen at home, instead of importing them from abroad. Extensive business firms and corporations with every desire to discharge their obligations to their employés, and often with a careful regard for their comfort and well-being, seldom give themselves any trouble about their manual instruction. It is pleasant to find at least one employer who felt himself under the necessity of making the utmost exertion and of using every means to instruct as well as employ them. I am glad to notice such a case. I refer to a gentleman who informed me that some thirty years ago he started a railroad-car manufactory of which he was the sole manager and mechanical head. The business embraced about a dozen of the leading trades. He

began with the men he could find in the vicinity, only one of whom had any knowledge of car-building, and others had little mechanical skill of any kind. He selected fifteen of those who were best adapted to that end for a free night-school in technical knowledge. He taught them drawing and the principles of construction, and he soon found a great advance in their efficiency, and that it was the most fortunate plan he could have taken to put his efforts on the surest and quickest road to an intelligent and effective body of men. He educated them until they could advance by their own efforts. It stimulated hope and energy which carried some of them to high attainments, and their attachment to him was such that he always experienced the benefits of their constancy and skill. He still makes his workshops a practical school for boys, almost uniformly with success, and has qualified a large number for usefulness and prosperity. He is never troubled with strikes or trade combinations.

If every manufacturer felt himself under the same necessity of giving some attention to the practical education of his men, success in business would be greatly increased, and the interested and active zeal of their intelligence would be productive of good work and good feeling.

The opportunities for industrial education will be many and varied when the leading business concerns will do something for the education of the young, in order to fit them for useful work and profitable labor. They now receive constant appeals from those having boys for employment. Widowed mothers urge that their boys are greatly endangered for want of something to do, and very often that they stand in need of their assistance to eke

out a subsistence. When public sentiment understands the importance of manual education, and that it can be successfully made an element in our public-school system, many of our large industrial establishments will provide practice-shops in connection with the public schools, where shelter, power, and machinery will be furnished at very small cost for practice-lessons, and the work of the scholars will compensate for rent and damaged materials, and the natural faculties so greatly varied in individuals would surely advance from the lowest to the fullest skill.

The true object of industrial education is to make both art and science contribute their ideal influence to our useful pursuits. By this means the artisan is taught the mechanical application of the studies of the philosopher and the artist; and so thought and industry form an alliance of mutual dependence and elevation. In his address to the Harvard students, Wendell Phillips referred to what he called a remarkable comment of Lord Brougham on the life of Romilly, enlarging on the fact that the great reformer of the penal law found all the legislative and all the judicial power of England, its colleges and its bar, marshaled against him, and owed his success to mass-meetings and popular instinct. It would be an entire reversal of this passage if the industrial classes themselves were found retarding rather than promoting a reform in their own interests and honor. It would prove that conservatism is not the exclusive privilege of any class. But, whoever opposes the movement, it will go forward. It concerns all classes of our people, for, as Professor Smith says, "unless the technical education of the producing classes in America is provided for better than it is now, that is, general education in the elements of art and science

for every child, and in the practice of industrial skill for youth and workmen, all the great natural advantage of this country in extent and variety of native products will be neutralized and destroyed."

The same author, referring in the same report to the indispensable necessity and great value of industrial training in a general way, observes :

I would impress upon you that this is a question of general and not of special education. The establishment of special industrial schools only, which, after all, is only patchwork veneering, and remedial, not organic and preventive, will not meet the difficulty. That has been tried and failed, and will do so again. You did not dispel illiteracy and ignorance by educating one quarter of one per cent. of the population, but by teaching all; and you will not, by any system of special industrial schools that a community will willingly support, be able to educate even so small a percentage of the whole people as that very insignificant fraction, nor accomplish more for industrial skill by them than the education of a few monks in the middle ages did for the general education of the people, without common schools. Our general education must include the elements of art and science, taught to every child in every school during the whole period of school-life, and in reasonable proportion of time to that devoted to other profitable subjects, before special industrial schools are aught but playthings, which they have been and will continue to be whenever and wherever they have been established, without the preliminary preparation for them has been provided in the common schools.

There is no country in the world to-day that can absolutely ignore public education in art and science without becoming impoverished. There is none, inhabited by white races, that has made so little provision for it as we have; and, as a consequence, no other country imports so large a proportion of the products of skilled labor as

America ; and that means a national leakage where there should be a spring of wealth ; raw materials exported, manufactured goods imported ; pennies-worths sent away, to pay for dollars-worths brought here. It seems perfectly unaccountable that, while the general education of the people has been so admirably provided for, even if too limited in scope, through being too exclusively literary and theoretical, and the technical education of the professional classes developed in the most complete manner, yet, though apprenticeships to trades have gone out of fashion, the artisan and mechanic are left without technical education, and, generally speaking, the American workman has to work by rule of thumb. Yet, so it is. I invite those who do not like this condition of things to remedy it.

While you cannot find in any country a body of men with more average intelligence and brightness than American mechanics, you can find none with so few opportunities of improvement, in their several crafts, by education.

As a consequence, our public taste and industrial skill are about in a similar position as the same were in England in 1851. If we are to make a change as radical and complete as was made in that country, we must adopt similar means ; and if the political economists are wise in their generation, they will find that there is no time to be lost in providing technical education for working-men.

Many other authorities might be cited to show the tendency of opinion. I give but one more. It is a passage from the report of the Boston School Committee for 1878, which I abstract from the same address :

The question of teaching trades in our schools is one of vital importance. If New England would maintain her place as the great industrial center of the country, she must become to the United States what France is to the rest of Europe—the first in taste, the first in design, the first in skilled workmanship. She must accustom her

children from early youth to the use of tools, and give them a thorough training in the mechanic arts.

The *École municipale d'Apprentis*, already described, cost the city of Paris \$150,000, and the working expenses amount to \$12,000 a year. Each of the two hundred and twenty-one pupils passes through the school on the average at a cost of \$55.50 per annum. The return to Paris, for her investment in this and kindred institutions, is the art and taste displayed in her fabrics, which assure her wealth and magnificence. Her workmen can design a carpet, decorate a wall, paint a picture, carve a table, engrave a jewel, embroider a screen, mold a vase, and add a grace and finish to every article of use or beauty, until she has become the acknowledged mistress of the world in the department of art-industry.

In the condition of the United States a much less outlay would be incurred for the public schools. They train the understanding until it becomes a reservoir of varied knowledge—the most complete system of mental development ever devised for popular instruction. Beyond doubt this can answer an admirable purpose, for it is an established principle with us that educated men and women excel those who are not so in whatever branch of work they engage. But what course are the graduates to take? Has this superb education given them the information they most need in this industrious world? Now comes the test. Here school-life ends; its motives, its preferences, and its work are now to be displayed in an entirely different order of things. Surely, one would think, after so many years of study, embracing the whole educational period of life to most of them, some of these

acquirements can be embodied in works useful and skillful, and that it would subserve the general purpose of uniting one portion of the body with the whole in its use, and that it would extend its helping power to all the parts, and summon them into the harmony of co-operation in a life of self-help and self-reliance. Does not the result of observation and experience warrant much of the sarcasm we hear, and draw from all the true friends of our school system an ardent desire for the introduction of such reforms and improvements as will infuse and impress upon all the pupils the living practical knowledge of the useful and the true? Professor Runkle, in noticing this deficiency, and in pointing out the proper remedy, remarks: "Suppose, now, that the same student had the opportunity during his school course, say till eighteen years of age, to go through a well-arranged series of mechanic art-shops under competent instructors; what are the chances that upon graduation he would not enter upon that pursuit for which he felt himself best fitted, and which held out the best prospects, not only for the pressing present, but for the future? That a course of education forms habits as well as tastes, is obvious; and it is unreasonable to expect that pupils educated almost exclusively through one set of closely allied subjects should show a partiality for pursuits with which these subjects have only the most remote, if any, connection."

If these views of the distinguished professor be correct, then there must be some defect in our system of instruction, and that defect must consist in limiting the studies to the intellect alone, and the exclusion of every element of practical or manual teaching. Perhaps this course, which is derived from the by-gone centuries, might

still answer, were it not for the wonderful development of the useful arts, and the imperious needs which they impose for industrial and educational improvements. Mechanic art is one of wider application to-day than any other branch of knowledge taught in school or college. To all men a knowledge of it is important, and to a vast number of pursuits it is indispensable; nor does it impart useful knowledge only, but confers also a most valuable discipline upon the higher faculties, for one of its ends is intellectual. Let it stand, therefore, in its proper rank with other studies, and be rated just as it compares with them in elevating and instructing the mind, and imbuing it with that kind of knowledge which will increase its powers and promote the usefulness and happiness of mankind.

CHAPTER XV.

Question of expense considered—Cost of workshop at Gloucester—At the Dwight School, Boston—Estimates of Mr. Chaney—Mr. Leland's school at Philadelphia—Of the Industrial School at Montclair, New Jersey—Estimates of Mr. Royce—Of the Spring Garden Institute—Helpless condition of the graduate, growing out of an exclusively intellectual training—Natural substances are fitted by industry for use—Cost of support for public schools—Object of education—Manual skill and knowledge—High-schools—Professor Runkle's remarks upon high-schools—Manual training; its advantages—Mechanical art—Multiplicity of talent—The benefit of generalizing illustrated by botany and chemistry—Applied to mechanic art—Drawing in all art—Generalizing tools—The use of machinery—Has not superseded the necessity for skilled workmen—Machinery has multiplied employments—Illustrations of the power-loom, printing-press, steam-engine, and cotton-gin—Effects of machinery in reducing prices and increasing conveniences—The demand for perfection of workmanship—Examples of well-paid skill—Inventions and industrial ambition—The forces of matter made useful—Machine-tools—Hand-skill still required—Building, carriage-making, etc.—The useful arts co-operative—The use of machinery not art—The trained artisan thinks while he works—Connection of science with useful art—The mechanic the true demonstrator—Science-schools in Great Britain—In the United States—In public schools—Education in the rudiments of science a necessity—Laboratories and workshops attached to high-schools—Not to teach a particular trade, but the underlying principles of all trades—Objection answered—System illustrated—Mr. Magnus—City and Guilds of London Institute—Finsbury Technical College—The system adapted to our public schools.

WE have somewhat considered the question of additional expense, and have contended that a course of indus-

trial training might be devised which would make its way by degrees into various forms of work without much increasing the public burden. This has been the experience in such schools as have tried the experiment of teaching some of the minor arts and the rudiments of mechanical industry.

In the special report of L. H. Marvel, superintendent of the Gloucester public schools, in estimating the expense of the industrial school there, he remarks that a room similar to the one at Gloucester can be fitted up for a carpentry-class at an expense of \$500. In such a shop, thoroughly and completely equipped, one teacher can instruct four classes each day, and twenty classes each week, of sixteen members each, and the actual cost of instruction would not exceed \$800 annually, allowing forty weeks for the year. The expense of stock would not exceed fifty cents for each pupil. Upon this basis the per capita expense of instructing three hundred and twenty pupils would be about three dollars a year. Probably the expense would be greater, if forging and casting were added.

The school committee of the city of Boston, in co-operation with the Industrial School Association, have made a practical trial of a workshop in connection with a public school. One of the rooms of the Dwight School building was fitted up for the purpose. A carpenter was employed as teacher. The session continued from January to May, 1882. The total expenses incurred in equipping and continuing the school were \$712. The principal of the school, in speaking of the great success of the enterprise, concludes in these words: "I consider that the results go far to prove that manual training is so great a

relief to the iteration of school-work that it is a positive benefit, rather than a detriment, to the course in the other studies."

The Rev. George L. Chaney, the President of the Industrial Association in Boston, submits the following observations in his report of a course of lessons in wood-carving, in regard to expenditure:

A single ward-room like the one used by the school in Church Street, in any city, for the six months from December to May, during which time it usually lies idle, with very little expense beyond the original plant and a moderate salary to the teacher, would meet all the needs of three or four of the largest grammar-schools for boys.

Three such supplementary schools, if used in turn, would amply satisfy all the rightful claims of industrial education of this kind upon the school system of such a city as Boston. At so small an outlay of attention and money might the native aptitude of American youth for manual skill be turned into useful channels. In so simple a way might the needed check be given to that exclusive tendency toward clerical rather than industrial pursuits, which the present school course undoubtedly promotes.

The School Board of the city of Philadelphia appropriated the sum of \$1,500 to defray the first year's expenses of the industrial classes in Mr. Leland's school; and that of Montclair the sum of \$1,000 for a teacher and shop-instruction which they associated with the public schools of that town. In his book on "Deterioration and Race Education," Mr. Royce estimates that at an expense of a sum no larger than \$20,000 an industrial institution can be equipped for the instruction of seven hundred and sixty-eight pupils to be taken through a three years' course,

besides evening-classes in wood-shops for—1. Carpentry and joinery; 2. Wood-turning; 3. Pattern-making: in iron-shops, for—1. Vise-work; 2. Forging; 3. Foundry-work; 4. Machine-tool work. The annual expense for the industrial education of each student would not exceed ten dollars. He furthermore declares that a shop teaching carpentry and joinery may be furnished—to commence with—for \$500; and that the industrial education of the entire youth of the United States need add no more than ten per cent. to the cost of our present school system; but that the addition to the public wealth would make the investment the best the nation ever made.

The Spring Garden Institute, already mentioned, completed a machine-shop for instruction in every branch of mechanical work in metal and wood, except casting, and the general account of the treasurer for the year 1882 sets forth the expense of fitting up the shop as follows:

MECHANICAL HANDIWORK SCHOOLS.

Salaries of teachers.....	\$366 00
Work-benches and other fixtures.....	82 15
Gas engine.....	790 27
Lathe.....	185 00
Drill-press.....	125 00
Planer.....	600 00
Files, chisels, and other tools.....	532 70
Forge, anvil, and tools.....	45 87
Twenty-six vises.....	177 31
	\$2,904 30

It is anticipated that, as the pupils advance in work, more expensive materials may be required and an increase in the number of teachers; but even with this inexpensive equipment the technical class is in full activity, and,

as already stated, nearly one half of its one hundred and five pupils are mechanics who work all day and attend the evening classes to obtain instruction which mere shop practice where they are employed fails to afford them. There are unnumbered thousands in our cities and larger towns who would be signally benefited by an industrial training of a kind as simple as this institute can give, who are now utterly helpless and dependent upon any chance job they can get. They consider themselves above labor, because they have no ability to work; but how far elevated above them is the artisan skilled in his profession, and how superior in every respect is his condition to that of the despairing crowds who are clamoring for something or anything to do! How many examples have we seen of young men veneered all over with the learning of our schools and colleges during the twelve or fourteen years which they devoted to study, come out at last without strength or skill in any of the ordinary purposes of life! Their education was addressed almost exclusively to the intellectual nature and its interests, and consequently they present the most pitiable form of helplessness in all that relates to their bodily wants and necessities. Their powers have not been impartially educated. Now, if man was of the spirit only, and if his employments were those of the reason only, he could dispense with the things appertaining to this base and refractory world, and dematerialize his life to that higher form of existence. But, alas! that is only one side of his nature. His wants and desires claim a most important influence not only upon his welfare, but also upon his mental and moral affections. The *cosmos* itself is his adversary. It is a globe of wood and stone and iron, of earth and air,

of sound and color ; and we find this truth, that in those periods when the ingenuity of our race was dead and dormant, the concrete forms of nature partook of the same immobility. To relieve them of their surplus fragments, to correct their restive or noxious qualities, and to adapt their excellences to the use of man, has been the task of his industry as well as the reward of his intelligence. The relation of education to the first as to the last will be better understood when we are willing to acknowledge that they jointly represent the physical organization of society and the refinement and elevation of human culture.

It is estimated that the school-buildings in this country have been erected at a cost of \$175,000,000, and that they are supported at a cost of not less than \$83,000,000 per annum. Whether any of this immense expenditure can be utilized for giving industrial training is a problem that will be answered either way according to individual prepossessions. One thing, however, appears very certain, which is, that the existing school system has failed to prepare our children for the practical pursuits of life. The reply may be made that it has not undertaken to do so. But I should prefer to think that no one would urge that view, for it would be a *cognovit* of its decrepitude.

It has passed into a truism that the main object of education is to prepare the pupils for the practical duties of life ; and as the common school is for the great mass of the people in order to benefit them, it ought to be directed to this end. We cheerfully acknowledge the vast importance of mental training, but there are other capacities that are essential to useful service, and whose cultivation is not less important to the individual or to the

public good. Upon what principle, then, if any, can the function of public instruction be limited to the cultivation of intelligence alone, and that no portion of the money raised by taxation upon all alike, should be spent in perfecting the manual skill and knowledge upon which the great mass of the children must depend in after-life? The requisites of a true education should contribute to the development of both, and literary courses should correspond with industrial courses, and, after the elementary grades have been passed, there should be no question of precedence, or any objection on the ground of expense. It is as if a legacy were left to two brothers, and one should appropriate the whole to himself. Manual industry is winning its claim to a share in the present school funds, especially since useful instruction in aid of that object can be added, as we have seen, to the public schools without much expenditure, beyond the salaries of skilled workmen to teach, and in some cases additional buildings for shops and machinery.

Perhaps no one ought to object to the creation of high-schools, although they are designed only for those who desire a superior degree of education; but the time has come to require that they should have annexed workshops for the introduction of the manual element as complementary to their theoretical studies. Professor Runkle remarks that if it is thought that a proper manual element should enter into the education of all, then the shops should be attached to the high-school, and serve to strengthen it by attracting students who now do not see any gain in the high-school course unless they have the college or some other particular end in view. "Admitting," he says, "that two three-hours' sessions per week

for the four years would be as much time as would be needed for shop instruction, then a series of eight shops arranged to teach twenty-five in a section would accommodate twelve hundred pupils. It is plain that only the laboratory method would make it possible to teach this large number of pupils, and one such series of shops would be ample for a good-sized city."

From this rational and consistent view, it must be admitted that the proposed system of teaching manual art is as general and elementary as any of the studies in the ordinary classes, but it has this great advantage over them all, namely, a liberal practice of the lessons in actual manipulation; and all those who have derived their views from experience inform us that one who has had no opportunity to observe this practice can form but little conception of its value in giving force and validity to the theoretical part of education, and to the peculiar aptitudes of the pupils. It is the method of teaching chemistry, astronomy, geology, navigation, mineralogy, and electricity, transferred to the study of industrial art. The remark is subject to but little limitation, that the latter is a necessity to the great body of the children.

Now, it is not urged against the studies of the high-school, that they give a knowledge to the pupils which they would never use in after-life, or use only incidentally, and that for this reason they should be excluded from the list of studies. Perhaps some of them might be discredited on this ground. But all knowledge is useful, and it will be a life-long benefit to any pupil if he can use the hammer, the chisel, and the saw, and understand the principles and movements of machinery. It will be of still greater service upon the character of those

who are thus taught. Industry and application will become familiar to them, which will greatly lessen the dangers from idleness and dissipation, for it will be much easier to find an occupation when one has a general skill than when he has none; he can also adopt the one which pleases him best, and which he can exercise to the greatest profit; and, when he is thrown out of work in one employment, he can turn his general skill and knowledge to account in another. The skilled workman can find the means of earning a fair subsistence even in the hardest times.

Principles are few, but art is infinitely varied. Large masses of men fill the different occupations in our huge manufactories, embracing founders, smiths, machinists, carpenters, pattern-makers, upholsterers, painters, fitters, mechanical engineers, designers, and superintendents; but whoever has been trained in mechanical art has the key to unlock the door to all these vocations. The natural faculties are as greatly varied in individuals as are the forms of art itself, and, when they are improved with rudimentary knowledge, they will enter freely upon their own development in an extensive class of hand-work, which is based upon analogous rules, and which require essentially the same kind of aptitudes. This multiplicity of talent extends throughout the domain of all art; it is observable in the works of great artists. Albert Dürer was a painter and designer. He had the glory, says a recent writer, of renewing the art of engraving and wood-carving. He practiced the art of etching, and produced marvels of skill with a dry point; and, like Leonardo da Vinci and Michael Angelo, he was an architect, a sculptor, a goldsmith, and an engineer; he designed fountains

with bas-reliefs, handles for swords and scabbards, and drawings for medals and coins. When the theory of art is understood, it only requires intelligence of mind and skillfulness of hand to fit any one for diversified usefulness and a profitable employment of his labor.

We have adverted to the power of generalizing the relation which is claimed for mechanic art, just as is the case in botany and chemistry. The immense number of species and variety in the realm of vegetable life would defy human ingenuity and industry, and the most patient and stupendous researches into their nature, structure, and growth would perish with the investigator who made them, were it not that whole classes of plants have characteristics upon which a theory can be founded, so that everything that grows upon the earth or is warmed by the sun can be classified and indexed according to the general relations which science has explored and discovered.

What Linnæus accomplished for botany, another illustrious Swede* did for chemistry. This science, founded on the somatology of natural substances, reveals the universal law of their relation. The chemist is able to represent the composition of numberless compounds by numerical formulæ which express truly and accurately to every other chemist the analysis and proportions of every combination of elements, and the reaction in which their relation exists. The extent and importance of the applied branches of this science to the useful arts may be judged of, when we reflect that there is scarcely a manufactory or workshop in which numerous chemical questions are not constantly springing up. In iron, pottery, and glass-

* Johan Jakob Berzelius.

works ; in the reduction of ores, the assaying of metals, and the elimination of gold and silver ; in the arts of printing, enameling, gilding, bleaching, dyeing, photography, and electro-magnetism ; in the preparation of gas, electro-light, coal-oil, fertilizers, explosives, combustibles, mixed metals, and innumerable acids for practical application, the accumulations of chemical knowledge are so vast and varied that no single mind could grasp them without a theoretical arrangement by which the facts and principles could be generalized into systematic order. . The "atomic theory," which gave rise to the numerical formulæ of the proportional elements in compounds, is like a common tool by which the whole can be manipulated ; and the discoveries and experiences of one chemist can be understood and appropriated by every other chemist as soon as seen, and can be acted upon, with entire certainty of the same result.

The same idea of plan and method is dawning upon mechanical art, and from the skilled mechanics of our technological institutions we may hope to see this demonstrated by an induction of facts matured into a splendid proof that there is a scientific method in the implements with which industry accomplishes its miracles of skill and establishes the triumphs of art. Why, then, may not the theory of tools be understood by the children, like other elements of natural philosophy, for it is quite as easy to learn ?

Of course, the matter of drawing is the great lever in all useful art. From horizontal, vertical, and curved lines in simple diagrams, the student proceeds step by step to the most complicated designs. The primary lessons are on a plane with his comprehension, but, as he advances

and combines, they lead him forward to a knowledge of principles of constructions progressively from simple forms to all the attainments his profession may require. So there are a few tools that, when mastered, give the key to a series of corresponding occupations. The square, saw, plane, chisel, and gouge can be applied to a wide extent of industries, and an ordinarily ingenious person, who has mastered their use, can advance himself at will to the highest skill in a large catalogue of work. In iron, the tools are the square, chisel, hammer, file, chuck, and lathe. A mechanic skilled in the use of these, and with a thorough knowledge of drawing and design, can perform a great variety of employments, for he enters the vestibule of all the trades that labor in wood or iron, on brass, copper, stone, tin, ivory, gold, silver, or the precious gems. Such may be termed general workmen, and in accommodating themselves to some strange labor they may not at first be quite equal to its requirements, but they can very soon make full use of their general knowledge and skill by acquiring a slight practice of the new element to be mastered. With a knowledge of mechanical art, with skill in the handling of hand-tools, and the leading machine-tools in general use, they can do excellent work all along the industrial line, and can reach high attainments, for the stepping-stones of progress have been laid at their feet.

We may be told that the use of machinery has so abridged the use of the hand, that few things are now made in which it is at all employed. In heavy manual labor the intervention of machinery has been immensely extended. Think of the steam-hammer that forges an anchor, the hydraulic press that lifts a bridge, or the Cy-

clopean furnace which welds a piece of iron that a hundred men would fail to move! Our dwellings, clothing, and food are prepared for us by the inventions of the age. These have introduced changes into the practice of every branch of industrial art; but it is a great mistake to suppose that they have superseded the necessity for skilled workmen. They have served to cheapen production, and to multiply beyond all calculation the number of occupations in the department of industry. And it is now seen that, as our tastes are cultivated for higher development in artistic effect, our increased facilities in the use of labor-saving machinery are absolutely indispensable to supply and gratify our wants. A complicated machine, like the power-loom, produces fabrics woven by iron-fingered operatives, and the girl who watches the tissue and stops the automaton when it has completed the web will weave more cloth than fifty men with the Oriental hand-shuttle. It was thought that this invention would bring idleness and starvation to the hand-weavers, and no doubt it did produce temporary distress to many; yet, how soon the increased production widened the field of demand, until it has become one of the most important branches of human industry and necessity!

Formerly books were copied by hand. The process was slow and costly, and those who could purchase them were circumscribed to a very limited circle. The great body of the people had no books, and even few of the rich could pay the price for transcribing them. But now the leaves are fabricated by one set of machinery, and covered with words by another, and there is no man so poor that he may not be the proprietor of volumes more beautiful and precious than those which adorned the

shelves of the great library at Alexandria. The commerce of books which this invention has created is not only diffusing knowledge and forming public opinion, but it has doubled every other employment, both mental and material. It has originated callings and crafts which were unknown when information was confined to the few. Paper-makers, machine-makers, type-founders and type-setters, engineers, book-sellers, book-binders, proof-readers and compositors, librarians, editors, and authors have mostly been created by the fiat of the printing and paper machines.

The steam-engine of Watt has probably increased a thousand-fold the industrial occupations of the world. It drives all the machines that work on wood, or iron, or stone, in cotton, wool, and silk, and achieves all the changes in their form which render them subservient to the wants of man.

One can scarcely conceive of the vast revolutions, the extended manufactures, the multiplied mechanic arts and refinements brought about by Whitney's cotton-gin. It would be impossible to enumerate the forms of labor it has originated in the textile industries of mankind.

The manufacture of gas from pit-coal, which dates from the commencement of the century, undoubtedly displaced much labor engaged in candle-making, and also the employment of seamen and ships required for the whale-fisheries to furnish oil to be burned in lamps; but, on the other hand, it has created an industry of incalculable importance, besides contributing to a host of other arts, many of which are collateral to and dependent upon it for subsistence. Its splendor, however, is about to be obscured by the blazing effulgence of electric illumina-

tion. Of all the elements, electricity is perhaps the most incomprehensible, but of all it is the most obedient; human ingenuity will therefore be able to turn it to many useful purposes; and when art has overcome present difficulties, and tempered its insufferable radiance to the softness of the sunlight, it will supersede all other modes of lighting our streets, our houses, and places of public resort. This may affect the dividends of stockholders, but both rich and poor, the scholar and the artisan, will participate in the benefits.

The grand effect of these and kindred improvements has been to introduce a marvelous economy of time and labor, and a corresponding reduction in price, which bring numberless conveniences and comforts within the means of all classes. They were once, upon a time not very remote, attainable only by the rich and noble, and many of them the greatest kings would have envied. These appliances seem to have done more in proportion for the humbler classes than for those of superior fortune or station. They make comfortable homes for the poor, and fill them with chairs, tables, knives, forks, and a variety of furniture on which the toil-worn artisan can rest or sleep; they decorate his dwelling with wall-paper and carpets, give him linen and blankets, and china and earthenware; they furnish him with glass windows and glassware and mirrors, and fill his kitchen, his pantry, and closets with all the conveniences of modern improvement; they enable him to sit in his own pew, and to enjoy a seat at the concert or the lecture; they make him familiar with broadcloth, and his wife with fabrics which, for elegance, were in her grandmother's day beyond the reach of a duchess; they afford him copies of

the finest engravings and pictures, and a large share of the treasures of art and literature.

But perhaps in no instance, so much as in the mansion of the wealthy proprietor, do we witness such varied utilities assembled, or the skill of so many craftsmen harmoniously combined. It is an industrial exposition to which the most subtle designs of the architect, the skill of the painter, the beauty of ornament, and the swart arm of the artisan, have equally contributed.

This universal demand for the conveniences of life could not be satisfied were it not for the machinery which has cheapened production so as to bring them into common use, and which has called into existence a multiplicity of useful arts in which science, genius, and industry find the most important and interesting avocations. The changes introduced by machinery, so far from doing away with the need of cultivated talent, have increased the demand for it in every calling. Nothing can illustrate this more forcibly than the ever-increasing and overwhelming cry for perfection of workmanship in every department of skilled labor, and the increasing rate of compensation it receives. Professor Weir, in a recent address, remarked that beauty of design as well as perfection of workmanship is that which builds up such a business as that of the Tiffanys, who excel the world. In cabinet goods Americans also excel, but all designs are imported. Workmen educated in France and England command here large salaries. There are designers in upholstery in New York who receive a larger salary than the presidents of colleges, and more than a cabinet minister. There are designers on the Leslie pictorial magazines who are paid \$150 a week,

while those of the highest ability receive as much as \$250 a week, to say nothing of what they earn outside.

The inventions mentioned above are striking examples of the instrumentality exercised by single contrivances over the destinies of the race; but the constantly increasing importance of machinery in the advancement of mankind shows how much remains to be accomplished by the ingenuity and skill of our artisans, and those who are to take their places hereafter. The boldness of industrial ambition, the various skill of the workers, and the vastness of the aggregate results, impress the mind with a sense of power that almost belongs to the sublime. It is to be remembered that these enormous mechanical giants have advanced to their present high organization by a gradual process of invention and adaptation. It has taken ages of experience to reach them. The forces of matter are gradually yielding to the inductive powers of the mind, and scarcely a year now passes that we do not convert their ductile agencies to our use. Every species of electricity is becoming subservient to our purposes, and galvanic heats are applied to numerous and important economies. Our investigations have not yet taught us all the applications of these new powers, for they have not been studied to any extent as they will be hereafter. Next to chemistry they are probably destined to hold a foremost place in the useful arts, and to make still greater additions to the industrial employments of the world.

Since the industrial revolution which resulted from the steam-engine, various contrivances have been constructed, under the general name of machine-tools. Now, while these tools do both heavy and fine work, they can

only be employed in large establishments, with an extensive plant and a great variety of machinery. The bulk of mechanical work for current wants in many parts of the country must of necessity be hand-work, as it is divided into so widely distributed details. Take as an illustration that of house-building. The material is all prepared by machinery, yet a large proportion, if not all the work of construction, is still by hand-skill, and of a far higher range of skill than is required for turning a machine; for, while the latter is routine work, the former is a continued presentation of new conditions requiring both judgment and skill. The building consists in simply making into concrete form the conception already illustrated by the drawing. It is one of the first necessities, and in its plainest form is very simple. The work begins in the forest. Trees are cut down almost entirely by hand-tools. The axe, in the hands of those skilled in its use, is a very effective instrument for many uses. It is a favorite with everybody, from the small boy with his diminutive hatchet; and its need to a great variety of purposes in domestic life can not be denied. Next comes the use of machinery for sawing the trees into various kinds of lumber, bringing it to straight or curved lines in rough forms. Another labor-saving machine of still more surprising power intervenes — the planing-mill dresses the lumber to a finer finish; and by still other contrivances the boards, posts, beams, floors, windows, doors, and moldings, are sawed, tongued, and fitted to match each other. But, before these pieces become a part of the structure, they are subjected in a great number of details to the hand-plane, hand-saw, and other hand-tools, for the purpose of minuter divisions and proportions, as well as

for finer finish, ornamental effect, and the best form of configuration. The heavy routine work is performed by steam, but the same skill in arranging the parts, the same dexterity in handling tools, and the same skill in finishing the job, are required ; for perfect work in architecture is a growing demand in all kinds of buildings.

So every part of wood or iron in the construction of carriages and wagons can be obtained all ready made. In new structures this is a great convenience. But to make the carriage a complete thing, requires constructive science of the highest order—to say nothing of the painter, the upholsterer, and the worker in leather, who are associated in the finished production. Besides, carriages are constantly requiring repairs which it would be impossible to provide for, especially in the rural districts, in any other way than by making the individual part needed for the special want. All this requires first-class hand-skill.

The same illustrations can be extended to all mechanical trades, for they are general in their application. The useful arts are pre-eminently co-operative. Thus, it is true that machinery enlarges the facilities of productive industry, and thereby increases the demand for a higher education in the theories and science of their movements, to make our greater facilities available. It is, after all, the hand-work of the artisan required in these operations that gives a distinctive character to the work, and makes it a speaking memorial of his skill and genius. The use of machinery is not art. A machine copies, and can multiply a thousand or a million fold the same article, and it makes them exactly alike ; but the skill with which an artisan designs his work, or invents a remedy for an unexpected obstacle, exercises the spirit of true art, and de-

serves the palm of refinement and originality. He evolves the present power to think and work and the future strength and courage to create the circumstances necessary to his success. The moment he takes up his work is that in which his mind is busiest, for by a natural adjustment, all his abilities are concentrated upon the subject in a common focus ; and perhaps the thoughts which agitate his mind will find expression in the excellence of his work, or in that which will add to its efficiency or improve its quality.

Of course, I speak of one who understands the practical bearing of the science upon which his work is based. There is a very general idea that the sciences have no connection with the useful arts of life, or that there is any need of cultivating them for the material uses of art. To educate a mechanic in science appears to many persons as absurd as it would be to give meat to a thirsty man, or drink to a hungry one. And yet it is of more importance to teach him that species of knowledge than to do the same thing for the scholar. He is the true demonstrator, for he reduces the theories of the philosopher to practice, and connects them with substantial uses for the benefit of all. The mission of practical science is to minister to industrial art, and of both combined to reign over the broad interests of mankind and the work which occupies their life.

The British Government, as we have seen, immediately after the first great International Exposition, organized schools in all the commercial and industrial centers throughout the kingdom for the education of working people in the various branches of science bearing upon their pursuits, with night-classes for those who could not

attend during the day. In this, England but followed the course which had been adopted long before in nearly all the Continental countries; and indeed in those days she had to import her chemists and other practical men of science from Germany and Switzerland. Within the last few years technological institutions have been in active operation in the United States, and extensive accommodation is now furnished in several of our colleges for instruction in all the applied sciences. But, as has been before remarked, these institutions are within the reach of only a few of the children in the public schools, and it is therefore a matter of sincere congratulation that arrangements, more or less liberal, are now made for teaching some of the broad truths of elementary science in the public schools, especially in the high-schools, many of which possess philosophical apparatus to illustrate the studies by experiments which lead to practical results. We have every facility in the United States for teaching the whole people the general truths of science. Unlike any other nation, which had to begin at the beginning by organizing a national system of education, ours is already in existence, and the education of the body of the people in general knowledge has prepared them in the best manner for mastering a degree of accurate information in one or more of the sciences which bear upon their industry. There are but few pursuits above that of common labor which do not require for their successful prosecution information of this character; for science is now connected with all branches of productive industry. Chemistry is connected with many arts besides agriculture; physics is connected with mechanical industry of every description, and mathematics is the basis of

innumerable arts indispensable to civilization. Education in the rudiments of science is a requirement and almost a necessity in present conditions. No great innovation is required. The study has already been ingrafted on the course, and all that is necessary to render this available for technical purposes is laboratory instruction in chemistry, physics, and mechanic art. It is suggested that the laboratory should be attached to the high-school, and should consist of two branches—one for scientific apparatus and experiment, and the other for machinery, tools, and workshop practice; and that in both the teaching should be by classes, and the students be required to perform experiments when sufficiently advanced in laboratory studies, and to learn their manual application in the workshop at stated periods, at least twice a week.* This is not in any sense a special course of study, but a general course in which the facts of science and art could be mastered in much less time and more pleasantly every way than are the abstract rules of rote-lessons which can be of little or no subsequent benefit; and it is here that the approach between literary and manual instruction is revealed, and where they manifestly exert a mutual and co-operative influence. We insist that all this is perfectly consistent with the idea of general training in the principles of knowledge, for it is designed only to teach what is of great value to all the pursuits of life, without teaching a particular trade to any one. And it is claimed that a general training in the laws of nature will not only

* To obtain this very object, Mr. Seaver, Superintendent of Public Schools in Boston, proposes to establish a central Industrial High School, in which the pupils may be instructed in the use of tools preparatory for actual life.

develop the intellectual faculties, but fit the student to master the special pursuit which he intends to follow.

It may be objected that the knowledge thus acquired would be superficial and of little or no use, and that no important results would be worked out by any one having only a little knowledge in a little corner of some science. Remember that this training, in a great majority of instances, will be followed up by a special application in some particular branch of industry. It is, therefore, only preparatory to practical work. Elementary acquirements are about all that education can bestow, and we know that they generally suffice for success. To disparage them as superficial is, therefore, to disparage all educational acquirements. There are a set of important facts which are attainable at school, and which will be serviceable all through life; and they are about as far removed from profound erudition on the one hand as they are from sciolism on the other. This species of knowledge ought to be included in what is taught by the school. In physics, for instance, how could the steam-engine be so well understood as by its presence in the workshop, and the analysis of its parts and powers explained while in motion? How could picture-making by the aid of a sun-beam be so easily learned as from the camera of an actual operator; or the wonderful results of electricity, as when worked out by instruments intended for the illustration of these phenomena? It becomes evident by such examples that science is not the exclusive monopoly of the learned, but that it belongs to every man, woman, and child who passes through the public schools, and that it is as much a part of art and industry as of philosophy and physic.

Mr. Philip Magnus, the very able Director and Secretary of the City and Guilds of London Institute, in his introductory address at the opening of the Finsbury Technical College, in discussing the relation of science to industry, said that the teaching in that school would be practical; that more would be done in the laboratories and workshops than in the lecture-room, and that it might rather be said that the lectures would form a commentary on the practical work, than that the practical work would serve only to illustrate the lectures; that the main purpose of the teaching in that institution would be to explain to those preparing for industrial work, or already engaged in it, the principles of science that have a direct bearing upon their occupation, so that they might be enabled to think back from the processes they see to the causes underlying them, and thus substitute scientific method for the mere rule of thumb.

Having mentioned the City and Guilds of London Institute, I again advert to it as probably the most complete scheme of technical education that has been devised. It originated with the guilds or trades of the metropolis; and their principal object is to promote the advancement of technical education in the United Kingdom by a system of laboratory and workshop instruction with explanatory lectures, both in the day-time and in the evening, for the benefit of those who are engaged or about to be engaged in industrial pursuits. The Finsbury Technical College is one of its adjuncts, and it establishes other branches or assists those already established in various parts of the country with both means and teachers; and confers certificates upon all persons who can successfully pass examinations, which it conducts in all the principal towns and

cities where a sufficient number of those who are competent can be found. This work it has successfully prosecuted for the last three years, and it promises more for the future to the industrial classes than any other system in England, not even excepting the noble institution at Kensington and its schools of art and science. The system coincides with the suggestions in this chapter, and fully vindicates the views just expressed. Our public schools would enable us to introduce technical training generally, and to make it omnipresent in the education of all the children, and consequently of the whole people.

CHAPTER XVI.

Chemistry as an industrial science—Its necessity in the art of dyeing—

Colors elaborated by chemists—Those derived from coal-tar—Its use in the fine arts and in other industries—Mathematics illustrated in the useful arts—Views of Herbert Spencer and Dr. Dick—Hydrostatics—Principles of the law of fluids and their application to industrial purposes—Electricity as a mechanical agent—Its subserviency to man's direction—Its wide diffusion and power—Progress made, and the new arts to which it is applied—Geology and mineralogy—Geological deductions—Irregularities in formation and their study—Various facts of the science set forth, which have been applied to artificial uses—Mineral wealth of the United States—Methodical study in our schools—The division of labor—Applied in every branch of industry, especially where machinery is used—If one has been educated in the mechanic art, he is not likely to become a machine—Technic knowledge opens access to many occupations—The invention of labor-saving machines frequent in this country—Universal education, its advantages—American inventions—London "Times" on the exhibit at the Paris Exposition, 1878—Those in general use—Causes of inventive activity—Classical learning, a digression—Amherst—The English language—Greek and Latin should not take all the time and space—True knowledge not to be sacrificed to verbalism—The ingenuity of the people is a national characteristic—Plan of education at Athens—Rome—In Germany—In France—England—Scotland—Lord Bacon and Locke—Bede and Alcuin—Mechanical training to develop our capacities—The effect of machinery upon the condition of the working-man—Various instances cited—Does it dispense with his vocation?—Agricultural implements—The railroad—Iron ships—Improvements give more and finer work than they displace—Machinery depends upon scientific principles—A knowledge of these important to the artisan who fabricates them—The study of mechanic art indispensable—Industrial instruction—England and France—It is a public question—It is a mistake to wait for local industries to begin the educational work—Wealth, population, and intelligence.

It was argued in the preceding chapter that there is no branch of industrial art which does not owe its im-

proved processes to an application of the laws of science. A knowledge of chemistry, for instance, is indispensable in many of the most laborious as well as in many of the most ingenious and refined of the arts. The wonderful developments in the art of dyeing, within the last thirty years, have been in a great measure owing to the investigations of such chemists as Davy, Dupuy, Bergmann, and Berthold, into the principles of impressing permanent colors upon silk and cotton tissues. The colors they have elaborated of a vegetable and mineral origin are computed at over fifty in number, and those from coal-tar, which are entirely new, rival in brilliancy and beauty the tints of the rainbow. The mordants which fix the colors in the fiber are also entirely dependent on the close observance of chemical formulæ. Chemistry is also of signal importance to the fine arts, and to glass and paper makers. A knowledge of some of its details is constantly in practical use by the miner and the metallurgist, while in the new arts of photography, gilding metals, vulcanizing India-rubber, in making stearine candles, and extracting sugar from other materials, the influence of this science is never relaxed for a moment.

Mathematical rules are universal in all forms of construction, and are constantly applied by the builder, the engineer, the mason, the brick-layer, the carpenter, the machinist, and the navigator. They are often laid down in mathematical tables which may be relied upon with safety in measuring the strength of materials, the transmission of mechanical power, and in many other particulars which illustrate their respective trades. But the engineer who lays down a meridian, or the sea-captain who reckons his latitude and longitude, or the architect

who determines the structure of a bridge, or the mason who ascertains the strength of his materials by the tabulated formulæ, works by rule of thumb, unless he can explain the elementary principles of geometry, or the scientific theories from which these rules are derived. He is like the boy who commits the abstract rules of grammar, without understanding their meaning. He is not a rule to himself, for he blindly follows the tables, and is incapable of any force when a case is presented which requires a critical opinion. Herbert Spencer dwells upon the importance of geometry in practical and technical education, and he declares that in the higher forms of construction some acquaintance with it is indispensable, and he proceeds to show by numerous examples how much it is involved in every pursuit and productive process. Dr. Dick also dwells on its utility and importance, and shows that upon the demonstrated properties of a triangle depend some of the greatest truths which we accept without knowing the reasoning upon which they depend, or perceiving the important bearings which they exert upon our daily life.

A thorough knowledge of the law of fluids is also serviceable for various reasons. Take, for example, the blunder of the ancient engineers, who acted upon the erroneous notion about water not running up-hill. They erected magnificent arches and costly conduits across wide-spread valleys and over mountains, to convey water from a distance into the city of Rome. We can now water a city with cast-iron pipes, because we understand the law relating to the pressure of fluids, and can carry them along the most circuitous routes, upon the bottom of valleys however broad, and up the hill-sides again,

provided only that the destination of the stream is not quite so high as the fountain-head from which it comes. This is on the same principle that artesian wells overflow the plain in proportion to the height of the distant mountains from which the water is conducted. This single principle is the basis of an infinite series of phenomena in the science of hydrostatics. From it is derived the rule that fluids press on every quarter laterally and vertically; that they can rise no higher than the reservoir from which they are drawn; that the liquid in a tube will counterbalance that in a cistern with which it is connected; that when compressed it will rend and tear up with the force of gunpowder, and that when expanded into vapor it can drive an ocean steamer, or perforate the solid strata of the earth. These principles in the law of fluids are exceedingly valuable in their application to a large number of industrial purposes, and their prodigious power is seen in dry and wet docks, hydraulic presses, water-mills, steam-engines, and fountains. Many other uses might be mentioned, for the engineer and machinist have exhaustless treasures of energy in the simple and abundant element of water. Then consider the marvels of electricity. In the opinion of many learned persons, the mechanical agencies now in use are exceedingly inconvenient and cumbersome, requiring an enormous outlay and expense for the production of motive power alone. It is asserted that when our mechanicians become acquainted with the power, abundance, and availability of electricity for this purpose, these costly expedients will be superseded by infinitely better and cheaper ones. These important changes can only advance from a knowledge of scientific principles. We know even in its present state of imper-

fection that, although electricity wantons under the form of the wildest contrasts—at one instant a destroying tempest and the next coursing the free air with the gentle elements of life—yet it is the phenomenon of a constant law ; and that its subservience to man's direction is as unlimited as it is implicit. Since the discovery of magneto-electricity by Oersted, and the experiments of Faraday and Henry, it can be generated by artificial means, and, like dynamite or gunpowder, packed up for transmission to any distance without diminishing any of its concentrated energies. The imagination revels in the wildest speculations as to the multitudinous uses to which it will be applied. It is not only to aid all the arts, but to supersede most of them by its innumerable utilities. There are those who even attribute to it the principal elements of animal life and the endless variety of form and beauty in the vegetable world, and who also claim that it prevails in a high degree in the senses by which we hear and see, and by which we taste and feel. But, however alluring the picture presented to us by the enthusiast, let it be borne in mind that progress can only be made from a knowledge of scientific principles, either in original discoveries, or in their application to practical purposes. In the mean time the progress made is verified in many ways. It encircles the earth's circumference with our messages, almost as soon as spoken ; it solves the most refractory substances like wax, and the hardest metals burn like paper in its incandescence ; it illuminates our streets and will soon do the same for our houses, with a light four-fold that of the sun's rays ; while telegraphs, telephones, photophones, photographs, microphones, and kindred contrivances, show that this mysterious agent which transmits

our messages can also assume many shapes and perform countless services to our race.

And, again, the principles of geology and mineralogy must necessarily be understood by persons engaged in many pursuits; for a knowledge of geological formations becomes important in discovering the mineral combinations with which they are usually associated. Especially is this knowledge exceedingly useful in ascertaining the location of mineral treasures, and where the ores and marbles range beneath the earth's surface.

Geological investigations fully demonstrate that, away back in remote ages, volcanic forces were rending the solid strata of the earth, turning the inside out and the outside in, and preparing the way for the aggregation, arrangement, and order of the mineral kingdom, and the evolution of the fluids required for the nourishment of plants, and the elements of electricity, nitrogen, carbon, and other agents necessary to the composition of the atmosphere, and for the maintenance of animated being. Homogeneous particles, widely separated, were brought into union, becoming artificers in the great laboratories of nature, assembling the waters in masses and the rocks into solid strata by affinity, generating trees and flowers on the exterior, and preparing within the dark bosom of the earth the coal-measures, the vein for the silver, the matrix for the gold, the quartz for the crystal, the topas, the onyx, the sapphire, and the diamond; the cavities for sulphur, for salt, soda, and quicksilver; and the beds for iron, copper, tin, and platinum. The minerals are not, however, diffused throughout the earth's strata with perfect uniformity, for in that case mineralogy would be an easy study. Every country

and island on the face of the globe contains unmistakable evidence of volcanic action in the disposition of its mineral veins and rocky beds, by which they have been thrown out of place and mingled with sands, shells, and shifting soils. Hence the mineralogical combinations which so often baffle the ignorant and disappoint the hopeful. The study of these irregularities is very instructive, and it is no exaggeration to say that millions of dollars have been squandered in useless experiments for want of understanding them.

This knowledge has been applied widely to artificial uses, and will be still more widely utilized by the making of all natural substances serve us more and more. There is scarcely a mineral that can not be found in the United States. We have even statuary marble and unexpected veins of sulphur. We have inexhaustible wells of naphtha, petroleum, silver-bearing veins, and an auriferous region of vast extent. We have mines of coal and iron, of lead and copper, which are found to be most abundant, besides many other sources of natural wealth that are being constantly developed from the cavities of the earth. It is needless to dwell upon the impetus which these developments have given to the industrial arts, and the wealth and power they have yielded to the country. The immense value of knowledge in regard to mineralistic properties will be admitted by all, and is the strong reason why the methodical study of this science should be made in our schools. Our youth ought to be put in a fair way to educate themselves and to apply the laws of science in the pursuit of any vocation in which they might engage. And when we reflect upon the value of the mineral kingdom to man, and learn from history

that the advance and retrogression of human opinions and enterprises can be measured by the refinement of the arts dependent upon it, we must certainly be constrained to accord to a study of its treasures the very highest rank in the sphere of industrial science.

But without entering into the particulars of all the branches of industrial science, perhaps enough has been suggested to show how intimately they are connected with all useful pursuits.

The course we propose seems entirely practicable, for the fundamental principles of the industrial sciences can be illustrated by experiments that will be exceedingly instructive and interesting. There already exists in many of the high-schools a scientific course that can be easily extended as required. Let a workshop be constructed as already suggested with each high-school, consisting of one or more rooms, and equipped with lathes, vises, carpenters' benches, machines for testing the strength of materials, a steam-engine and boiler, and apparatus for experiments on gases, fluids, etc.

As regards instruction, there should be a professor of applied mechanics who should lecture on machines and mechanism, on materials used in structures, the steam-engine, electricity, the mechanical properties of gases, liquids, and mechanical drawing and geometry, and perhaps pneumatics and optics. Under the professor there ought to be a skilled workman to give workshop instruction in the practical use of tools and machinery, and the conversion of materials into various forms of construction. Perhaps the same object can be accomplished by transferring into the ordinary course some one or more of the excellent programmes that have been tried

and tested in the industrial schools in this country or abroad.

The course should comprehend two lessons per week for at least thirty-five weeks in the year for each class, and the classes might be so arranged that each in its turn would receive the same instruction. In order to have time for this purpose, if necessary, other studies might be diminished by requiring a less amount to be memorized, less reading, less geography, less grammar and defining. I have reason to believe that the sentiments of the best teachers are that too much time is allotted to these lessons. One or two lessons a week in applied science and the manipulations of industrial implements would relieve the excess of intellectual studies, and make them more interesting and easy, because they would be inculcated by examples which employ the senses as well as the mind. The pupils would see and do the things as well as memorize the formulæ, and they would comprehend them while being taught. If the phenomena of nature appear marvelous to children, the art by which man has illustrated them is still more interesting, and the inventions by which he has compelled them to do his work fills them with delight.

The reform is easily practiced and immediately applicable. It comes in aid of general studies, and introduces into education both life and unity, for it will cultivate not one faculty or class of faculties exclusively, but all.

In the possession of scholars exclusively the existence or influence of science is scarcely appreciable, but in the hands of the artisan it is applied to all the useful articles and purposes of life. Shall we teach our children only to open their eyes to wonder at such things, and then

fold their arms instead of learning to master and apply them ?

The division of labor may be named as a settled condition of productive industry ; and it is asserted by many that it is to this influence we owe our superiority in many of the arts of life, if not our position in the scale of civilization. This principle has been applied to almost every branch of industry ; and there are now few articles manufactured by the aid of machinery that are not distributed to as many separate workmen as there are individual parts. This minute division of labor undoubtedly facilitates production, and perhaps insures perfection of workmanship ; but, on the other hand, it is claimed that, as it confines a man to the same operation, he gets to perform it in a monotonous way, without exercising his understanding or inventive faculties, and that he is therefore likely to become almost as much of a machine as the automaton he guides. Man has been defined to be an animal who makes machines, but, if he has been educated to think, it is not at all necessary that by his work he should himself be changed into one. If he has been taught the complicated elements of mechanic art in theory and practice, and understands the principles which underlie the process of which he performs but a small part, he will be restless to contrive expedients to better his condition or his work, and will at least be sure to experience the exhilaration which springs from the exercise of ingenuity and skill ; and in case a new invention should sweep away his fragment of a trade, instead of becoming an industrial outcast, dependent upon chance jobs for a precarious living, he falls back upon his technic knowledge, which opens access to a multitude of occupations.

Many labor-saving machines have thus been invented by ingenious workmen as a substitute for their hand-work. These instances are common among American mechanics. The general intelligence of our people, resulting from their universal education, infuses a corresponding habit of thought in all human pursuits. We do not know from modern history of a development in discovery or invention, extending from those that are useless to those that are admirable, that can be compared with what has happened in the United States within the last thirty years. They would require many volumes to do anything like justice to those alone which have merits. The columns of newspapers are filled with advertisements of these mechanical novelties, and our hardware-stores are magazines of them. Some of them appear almost imbued with intelligence. We have, for instance, machines for paring apples and picking huckleberries; for plucking feathers from live geese and taking pits out of cherries; for putting up packages, soldering tin cans, and counting cash; a flexible shaft for carrying power round corners; and a shoe apparatus which will convert a hide into shoes in about as short a time as a cobbler could pound a single piece of leather on his lap-stone.

Remarking on this idiosyncrasy, the London "Times" wrote that "the New-Englander is an inventive animal. We are told that his brain has a bias that way. He is always restless to fix up something in a more convenient fashion than it has ever been fixed before. No matter what his training or what his calling, his mind is working in a kind of back-yard over some idea for economizing labor; he mechanizes as an old Greek sculptured, as the Venetian painted, or the modern Italian sings; a

school has grown up whose dominant quality, curiously intense, wide-spread, and daring, is mechanical imagination."

Indeed, it is not, when fairly and discreetly examined, an arrogant claim to compare the practical inventions of our workshops with those of the whole world arrayed *seriatim*. This was seen in Machinery Hall at the Centennial, and again at the Paris Exposition in 1878, where our mechanical display, though small in space, took all Europe by surprise, and gave the palm of originality in practical invention superlatively in our favor.

In the leading and more important inventions, the instances of American genius are almost equally manifest. All parts of the civilized world use to a greater or less extent American inventions. The applications of steam to the propulsion of vessels, the perfect conductivity of the electric fluid and its use for purposes of communication, the propeller, the turret gunship, the revolver and breech-loading ordnance that have changed the manœuvres of war; chloroform and artificial limbs to assuage human suffering; the telephone and electric light; an almost endless variety of agricultural implements which have revolutionized the tillage of the soil; gutta-percha and its marvelous applications; the writing-machine and the pegging and sewing machines, are among the inventions which have sprung from the rich storehouse of American ingenuity, and which have successfully linked themselves with the industrial arts and employments of the world.

Our thorough system of general education may claim a large influence in creating this inventive activity, for intelligence makes men quick to see what is needed, and

fertile in expedients to render their labor more easy and efficient. An ignorant man is not moved by such motives, and learns little from experience. General instruction is therefore a great advantage, and when the students enter upon practical work—which, however, they now seldom do—it greatly stimulates all the faculties to save labor and expense. It ought, however, to be understood that to teach those branches which train the intellect alone is instruction, but in no true sense education. This theory does not account wholly for the inventive faculty. The high price of labor which seeks for less expensive methods, the protection of the patent-law, and the great pecuniary value of a successful invention, have been powerful motives to these triumphs of industrial art. But to all these must be added the innate resources of the American people, by means of which this country has so successfully assumed the place it holds in national existence. This gift can only be carried to its greatest usefulness by cultivating the faculties with which it is intimately associated. How shall we popularize labor, so that it shall attract intelligent men and so pave the way to improvements grander and cheaper than any that have yet appeared? Manual knowledge in mechanic art is required by the masses, who have no fortune except their hands, and who can see no way of subsistence except by their eyes. What is to be done with this vast population? To win them to the knowledge and attraction of work is the great mission of the new education. Knowledge becomes attractive when related to our business. It is time to see this as one of the ends of education. What would we think of the husbandman who should cultivate the lilies of the field for their beauty

and fragrance, and neglect all the homely but useful plants that produce wealth and support physical existence? And this is very like the vice of our school and college system. The common truths of science and art have been abducted by the professors of verbalism, and their living sympathies with our needs and necessities have been postponed for the business education of practical life. I do not wish to speak in any narrow spirit of classical learning, but it is notorious that the critical study of the dead languages exists nowhere in this country except for a very limited sphere of scholarship, and it is made optional after the first year in the courses of some of our oldest universities. Like everything else in nature, it has its time and place, but, instead of occupying nearly all the time and all the space, let it be curtailed to the limited necessities imposed by modern conditions, and placed in one of the back seats where it belongs. To teach in one of the technological institutions—like the one at Boston—requires vastly more learning and real attainments than to disseminate a knowledge of words and language; and yet the great faculties of science and art, and their relations with industry and philosophy, hold an inferior rank in university honors. This aristocracy of talent has monopolized the good things in the garden of knowledge, and they confer the degrees of Bachelor and Master of Arts, totally unconscious, apparently, of the solecism they commit.

The correlation of science with human sympathies has never been frankly recognized in our colleges, and it is not very surprising that it is dying out altogether at Amherst. Its place and kingdom have been given to other studies, not from any want of attractiveness or vitality in

itself, but because it was dishonored in the temple where it should have been worshiped. To inform us that the youth of Amherst do not take willingly to the study of the largest and noblest principles of human knowledge ought not very much to disappoint any one, since these truths are stamped by Alma Mater herself socially and intellectually with inferiority. To trace the nominatives of Greek verbs and the relatives of Latin antecedents involves a species of mental discipline, and the excellences of ancient literatures will probably always entitle them to a reasonable amount of attention. Our obligations to the Greek and Latin races are very numerous and very important. Let us acknowledge them with gratitude, but at the same time remember that we have a tongue of our own which, although it does not approach the classic language in perfect analysis, has yet equal power of expressing the various forms of thought, and embalms a literature of the most elevated sentiments, and conceptions of the boldest as well as the most harmonious periods, and of an eloquence vigorous and graceful, massive and resonant in its structures. Its accent is heard in every part of the habitable globe. Why overlook this branch of instruction, and compel our youth to spend several years of their most valuable time in acquiring the essentials of what is termed a classical education? If it is thought best to continue the propagation of this learning, it should no longer rule as king in the domain of education; but the children of science imbued with the greatest truths, and those of art with their splendid retinue of refinement and utility, should take the time and honors to which they are entitled. All true intellectual culture must depend upon the drawing forth of the intuitive

powers, or, in other words, the capability of generalization and deduction should not be sacrificed to verbalism, or the exercise of memory as distinguished from thought. There can be no rival to real knowledge for this work. To the accurate sciences as our guides and instruments we owe our power of solving the ordinary inquiries and necessities of life, as well as the sublimer problems of the universe, and an undoubted supremacy ought to be yielded to them for the enlargement of our views and judgments, and there should be no hesitation in assigning them the highest place in any scheme of liberal education.

But to return from this slight digression to the subject of the mechanical genius as developed in the character of the American people. It must be evident that any general system of education for the masses, which fails to mold this singular ingenuity and address to certain elements of knowledge so that they can act intelligently on all industrial objects, has either misunderstood its mission, or has been unable to comprehend the mental circumstances which represent the characteristics of the national mind. Some predominating views or general plans have exercised a marked influence on the education of almost all nations, either ancient or modern, having reference to the peculiar bias of the population. For instance, the aim of education at Athens was to develop the genius of art and beauty of form. In Rome, it was directed to acquirements of general utility, and such as would render the Roman citizen prompt to serve his country. In modern Europe, the Germans originated the Reformation, invented printing by movable types, and soon after produced many great artists whose works became monumental ; but

they were mainly an industrious people working in homely diligence. In conformity with this trait, they established the "people's schools" all over the land for general education adapted to the industrial classes. It was not until the middle of the present century that they began to develop those numerous and magnificent schools for instruction in almost every branch of art-workmanship.

The French are gifted artistically, and consequently art-industrial schools were established at an early day to foster and develop this principle, which seemed to be original with them, and which has for centuries been the foundation of their prosperity. Eight centuries have passed since Charlemagne required every endowed monastery to support a school, and arrayed himself in garments woven by the scholars of industrial schools which were attended by his own children.

Although England is the cradle of constitutional freedom, she does not seem to have had any plan or scheme of education except in the richly endowed universities for the education of the nobility and gentry. The learning of Bede distinguished him in an age of darkness, and Alfred the Great was a student and writer whom tradition has invested with every ideal of knowledge and virtue. It was the Anglo-Saxon monk, Alcuin, who became the preceptor of Charlemagne, and kindled the torch of learning at the court of that great monarch. The philosophy of Lord Bacon finally substituted real methods for the sophistical, and the rational for that of Aristotle and Pythagoras; while soon afterward Locke vindicated the great principle that education should consist in teaching the truth of things and enriching the intuitive powers of the understanding and judgment. But it was not until

the unfavorable exhibition of her art in industry at the Crystal Palace that education befitting the people actually commenced its brilliant and irrepressible career in that country, and she has since taken the lead of all other European countries except Germany for the general education of the common people, and the elevation and refinement of those engaged in her vast industrial pursuits.

The Scottish nation gave the first example of a free church and a public school. Recognizing the eminently practical qualities in the character of the people, the Scottish reformers established a school in every parish, and the system has been improved and extended by the care and wisdom of succeeding generations so as to make it commensurate with the wants and relations of merchants, bankers, artisans, and laborers.

On the same principle, why should not our system of public instruction afford the best means, or at least the rudiments, of mechanical knowledge to meet our peculiar tendencies? Practical lessons in wood and iron, in the use of tools and machines, would be beneficial as general information in this productive age, while they would cultivate the judgment and expand the mind, and they would also find their uses in many ways in practical mechanics. As preliminary studies they could be called into aid, whether the students became merchants, manufacturers, or artisans; and would give proper direction to the inventive instincts of our people. New thoughts would arise from knowledge to make new things possible and profitable. Can it really be a serious question whether this is the only country in which the public school is incompetent to direct teaching in relation to the genius of the general mind and to the altered conditions of the age?

Unless education reaches this subject, unless there is the most practical teaching on this point, invention will proceed upon imperfect knowledge of fundamental principles, and time and money will be expended on impracticable objects, and often with the most unfortunate results. Fortunes have been literally sunk in the ground for the want of a little knowledge in geology or mineralogy, and it is to the same lack of skill that most of the disastrous and fatal accidents connected with the use of machinery are to be attributed.

Nearly everything is now made by machines, and this will continue more and still more to be the case to reach the minimum of human labor. The impression is still cherished by many that the effect of this upon the material well-being of the working-man is to displace his employment, and, by cheapening the cost of production, to diminish his wages. It is, however, the incompetent men that are discharged. Machines can not manufacture skill or art, and therefore, although the mechanical appliances are so numerous, the demand for skilled workmen in every branch of art-industry is so great that tens of thousands are every year imported from Europe. There are cheerful views to be derived from the history of the useful arts. Machinery not only relieves from hard toil, but it multiplies the number of occupations in a ratio far greater than the work it displaces. Every discovery in nature and every invention are followed by new arts requiring more refinement of mind resulting from a better form of industry. Once upon a time the soil was plowed by main strength, and wheat was trodden out by the feet of oxen or thrashed by the flail; the flour in our bread was pulverized by a hammer, or ground in rude, inartifi-

cial mills that bear little or no relation to our present methods. The grain is now removed in an instant from the place of its growth and dispatched to every part of our own country and to distant marts all over the world. This is the result of machinery, and the industries incident to the new mode of tillage are on a scale of unexampled magnitude. Towns and cities have sprung up where but yesterday were the hunting-grounds of the wandering savage.

Another familiar example is the railroad. Before the locomotive existed, stage-coaches and carts were about the only means of conveyance to all persons except those who owned their carriages, and few there were who traveled then ; and the only means of transportation were slow canal-boats and heavy teams of horses or oxen. Journeys were few and freight restricted. A grander way was required, and man's inventive genius discovered it. He constructed bridges over angry floods, filled up wide-spread valleys, tunneled the mountains, graded the hills, laid down the iron track upon which he placed the iron horse and the resistless car ; and now he flies and turns and whirls, until the distant yonder becomes the here, and the here is everywhere. He also hitched the power of steam to ships of hammered iron, and makes his way through counter-currents, resistant waves, and adverse winds, to the most distant homes of men. There are numerous other inventions to which the same remarks would apply, and the arts which they have added to industry or the existing ones which they have indefinitely extended are so varied that they can scarcely be classified. They present a concentration of capital and labor, of applied science and practical knowledge, which marks this era of industry.

Now, all these inventions are based upon mathematical, chemical, and mechanical theories. The locomotive, the steam-engine, the sewing-machine, the steam-plow, the reaper and thrashing implements, the railroad-car and the ocean-steamer, the power-loom and the telescope, all require a practical and technical knowledge of scientific principles in their construction. This is indispensable in order that they may be either safe or useful. A bridge remains firm only when it is built on sound calculations, and a machine is only useful when it is constructed on correct mechanical rules. How important, then, that every builder, machinist, and engineer should understand the rules which furnish infallible methods for his work, and particularly is this knowledge essential to the artisan engaged in the fabrication of machinery! A man may not be able to form a critical opinion upon a matter of abstract science, but surely a mechanic should know how the parts of a machine are to operate and how they will react on each other; how its various movements are to be affected by the motive power, and what conditions are to be observed in order that good results may be obtained; and also in order to prevent the loss of life and property, which is so often occasioned by blunders and ignorance. In the elementary principles of mechanic art will be found a study of eminent utility to all the pursuits of life, but which will be especially serviceable to the inventor, the manufacturer, the artisan, and the operative. Mechanical learning is therefore making its way into the culture of the age, and there is a growing sentiment in favor of its teaching in our schools.

“Industrial instruction,” says a recent writer, “is demanded by every principle upon which our general edu-

cational system is based." We must pay a fair price for it. We can not expect frugality, industry, and skill when we have taken no means to secure them. When England became conscious of her inferiority, she established her art and science schools, and has made such giant strides in art-production that the French have been obliged to redouble their efforts in order to retain their traditional superiority. We are in the condition England occupied thirty years ago. What shall America do? We have found that general literary education will not answer this need. Our schools are admirable, numerous, and expensive, and yet we stand at the bottom of all civilized nations in everything relating to industrial education. This is a question that concerns us all—the buyer, the seller, the worker, the poor, and the rich. It is a public question, for our arts are passing into the hands of aliens, and our markets into the control of foreigners.

A writer in "The Popular Science Monthly" magazine argues that no central organization or institution can be expected to do the work which, at the outset, the local industries must initiate for themselves, and develop by their own resources. Not so thought England, when she organized her great industrial museum and art-schools to encourage and improve her manufactures, before "local industries" had laid the foundation of a single institution in the kingdom. Not so thought Germany, which has evolved some of the most important additions to human knowledge and advancement within the last three hundred years, when she seized this problem in her robust intelligence, and solved it for her own people by establishing an industrial school by law. The New England Puritan planted the common school in the wilderness, and

the Western pioneer builds the school-house and the log-cabin simultaneously. It is the need of these things that induces public action before the young can grow up in ignorance and idleness ; and it would indeed be a mistake to wait until they had been locally developed, and the statistics of their success had excited popular favor. There is an opportunity for endowing a school of this character in every town and city ; but do the local industries turn their attention to the necessities or tendencies of our times ? And in view of the notorious incompetency and indisposition of these bodies to elaborate plans of education to supply the need, we can scarcely look to them for the proper remedy.

Now, since the great mass of the children in the public schools will have to depend upon some kind of employment for a living, is there anything unreasonable in affording them an opportunity to acquire that kind of knowledge which will open up to them every form of skilled workmanship, which will emancipate them from the narrowness of a single trade, and make them useful and prosperous citizens ?

In a commercial and artistic point of view, the advantages of mechanical skill and its combination with beauty appear to be unlimited, for beauty and skill are sold in the market, and delivered to the highest bidder. The people who produce the fleetest ships, the finest fabrics, the most effective arms, and who possess an economical and richly productive agriculture, and a varied and educated mode of manufacture and general industry, will always have greater wealth, population, and intelligence than it is possible to attain without them.

CHAPTER XVII.

Moral influence of industry—West Philadelphia Penitentiary—Criminal statistics—Necessity of manual training to correct degrading views of labor—Also as preparatory for the safety of society—Advantages of industrial education to workmen—It improves their condition and cultivates the moral affections—Early impressions—Mr. Richards's views—Exclusive intellectual training creates a disdain for labor—The connection between idleness and vice—Public schools progressive—The friends of industrial education should vindicate the public schools for their reconstructing tendency—Mr. Fraser's report to the British Government—The improvement of public schools since that time—The education of Indians—Hampton Institute—It is an industrial school—Indians taught trades—The best way to educate and civilize them—Manual training as an antidote to over-study—Dr. Richardson's views—Boston committee on the subject—The Industrial Home School at Washington—The effect of skill in workmanship upon the condition of the workers—Science and art mutually aid each other—The laboring artist reappears—The establishment of Messrs. Minton—"L'Art Revue"—Fine art in the United States—Production in art-industry—Its humanizing influence—Art and science—Mental industry and material industry in close alliance—The worker is rising higher and higher, and is gaining in intellectual enjoyment—Industrial education the working-man's best friend.

It may also increase our interest in the economic aspect of our subject if we reflect that intelligent labor is the cheapest police of society, and the main-stay in the moralities of law and order; that it not only secures the means of subsistence, but effectually takes away the inducements to idleness and vice. It is an old proverb that

idleness leads to poverty, and often to crime. A good journeyman is usually a good citizen. We seldom, if ever, hear of a skilled machinist in the penitentiary. Recorder Vaux gives some interesting figures concerning the penitentiary at West Philadelphia. They cover two decades, from 1860 to 1880. In the first, there were 1,605 prisoners received. Of these, 1,115 could both read and write, but 1,217 had never been apprenticed to a trade. In the second decade, there were 2,383 prisoners received. Of these, 1,677 could read and write, but 1,950 had never been apprenticed.

Mr. George S. Angell, who abounds in all kinds of good works, informs me that out of 1,368 prisoners in the Auburn State Prison, New York, a short time since, 1,182 had a greater or less education in colleges, academies, public schools, and elsewhere. As showing the increase in crime, he states that even in Massachusetts it doubled in one decade. In 1865 there were about 10,000 persons confined in the various prisons of the State, and during the year 1875 there were 20,000; and that about twice as many arrests are made annually in the city of New York as were made in all Massachusetts during the year 1880—namely, 71,477. He also shows that the destruction of property by fire increased in ten years from \$35,000,000 in 1868 to about \$100,000,000 in 1878; that there are large organized societies of criminals throughout the country; that the largest proportion of the criminal classes are young men not over the age of twenty-five years; that generally they can read and write; and that in no country are life and property more insecure than in portions of the United States. Among the principal remedies he suggests are industrial schools and the plant-

ing of colonies on the unoccupied lands of the Government, in order to give occupation to the unemployed.

From this it would appear that a mere deficiency of ordinary education has less to do with the existence and appalling increase of crime than idleness and the lack of knowing how to work.* These criminals had been taught no useful art, and their intellectual training had little or no influence in counteracting their criminal propensities. The tramp is a recent phase of debasement. The crowded tenement-houses in our large cities swell immensely the statistics of brutality and dishonor, and I fancy that an artisan with competent knowledge of his profession never gravitates to these dens of wretchedness and squalor.

In referring to criminal statistics, a recent writer has remarked that

The cost of the depredations of property, the detection and detention of criminals, their trials, the cost of their support in prisons throughout the United States, and all the paraphernalia of criminal jurisprudence, might be set down, at the least calculation, at \$500,000,000. Put this sum of money in industrial schools throughout the country, and it will give fifty dollars a head for every child in the land. This would be a cheap investment compared to the expense of detecting, adjudging, and maintaining criminals; for this is 'a stone that can never

* If I am correctly informed, there are only four persons out of every hundred in Pennsylvania that cannot read or write; it follows that this four per cent furnished in the first decade nearly one third of the criminals in the Philadelphia penitentiary. It is also stated that less than twenty per cent of the total population of Pennsylvania are apprenticed; it follows that the criminals were furnished in about equal proportions from those apprenticed and those unapprenticed. In the absence of official documents, I rely for these statistics upon one in a position to know.

be rolled to the top of the hill,' but ever rolls back again ; while industrial education would give us, out of one generation of children, a cheerful, orderly, serviceable people, self-respecting, and respectful of law.

The remedy here suggested for the evils complained of I unhesitatingly assume is the substantial one—viz., to train those who are to become citizens in the fundamental rudiments of the arts of necessity, to teach them to do something. If this is not done, the things that have happened will be repeated indefinitely, and the children will be delivered up to the thought that there is no work in which they can engage, and no way possible in which they can acquire a knowledge of work without great waste of time and drudgery ; and they will thus inevitably acquire a disposition to get along as best they can without it ; and to yield to the example of so many others in a sort of disdain for those who labor, until they confound all obligations to be useful into a skepticism of their ability to earn an honest living, and that, as the public have educated them into this belief, it ought to support them. Who can doubt the salutary influence of practical teaching upon the great evils of society—idleness, and the consequences which flow from it ? The pupils would find as much interest as profit in manual lessons—lessons at once scientific and useful—in harmony with modern demands, and preparing the future citizen, the future artisan, and the men of action who are to carry on the great industries of society, in which the laws of God are to be respected, justice upheld, intellect cultivated, taste diffused, and human existence embellished by industry, morality, and genius. In the relations of life there is a moral obligation to know something practical in order to live, and a

knowledge of exterior things is necessary to guide us surely in regard to what is either useful or good.

In former parts of this work I have thrown out many remarks to show that the industrial schools in Europe had provided the pupils with knowledge which enabled them greatly to improve their condition, and that it affected favorably, not only their habits, but their morality, giving them a taste for study, and ideas of order and providence which contributed powerfully to their well-being and that of their families; that the advantages conferred upon workmen by these institutions were corroborated by the strongest proofs, some of which were stated and need not be repeated, and, among other benefits, that they were better fed, better clothed, better housed, and better behaved; and their condition morally and socially improved in a very remarkable degree; and that vagrancy, drunkenness, and crime had almost entirely disappeared where industrial education had been conducted with judgment and success.

The influence of art-industry is not only that it multiplies objects of value, not only that it creates and beautifies those which are prized by the affluent as well as those which are necessary for the poor, but it strengthens all those important influences upon which our moral affections depend for their support and permanence. Human virtue results greatly from our surroundings. Give the people lucrative employment, and you will do as much for their morals as for their comfort. Skilled labor commands the highest wages. A man must have a pleasant home, clothing suitable for his family, the means of educating his children, and a proper reception in the circle of society to which he belongs. Now, the same industry,

mechanical skill, and ingenuity combined in the productions of useful art will also procure these different but equally indispensable ends to human happiness and moral excellence. The skilled artisan, by the exercise of his profession, becomes refined in his tastes, and he provides his family with innumerable comforts, which—

With sweet succession taught e'en toil to please.

If industrial training alternated with mental exercises, it is not unreasonable to conclude that the habit of industry would make a lasting impression upon the pupils, and that upon leaving school many would enter upon some useful pursuit according to the bent and aptitude which had been developed by their studies. We all know the strength of early impressions, and that they often exercise a controlling influence over a lifetime. Says Mr. Zalmon Richards, in his premium essay upon the true order of studies: "Children should be so trained in their early education that they may constantly feel that all their intellectual attainments are valuable only as they use them in the legitimate employments and duties of life. Right here we find some of the gravest defects in our systems or methods of training. Thousands of our youth come from their schools of every grade with aimless purposes, and many of them spend aimless lives, or else, perhaps, they think their intellectual training entitles them to a living anyway without hard work. The industrial training needed, and herein advocated, is not a special training for a trade, nor the learning of a trade, but such as will fit all children for any trade or occupation, and show their capacities and aptitudes for any desirable employment, so that they will not be liable to make a

mistake in choosing an employment for life, as thousands do."

The views of this accomplished and practical educator are in perfect accord with universal experience, for it is a fact that the bias which the young receive during the period of school-life will generally remain to influence their conduct afterward: their ignorance of the principles and practice of industrial art, and the unfavorable opinion which their exclusively intellectual training has given them of handiwork, are so inveterate that but comparatively few of them enter upon industrial careers; while many of them actually imbibe a feeling of disdain for useful employment. If industry were taught and exemplified in practice for several years when the mind is susceptible to every influence, and when the habits can be molded into harmonious relations with necessity, it would be of immense importance in the individual life and moral character of every being. The intellect is the reasoning faculty of human life; but the passions are greater in intensity, and work in restless agitation to control the whole character and conduct of the man. Idleness is the well-spring of their power, but industry is one of the limitations to this influence, and a powerful check to chastise and endow it with moderation. It would at least curb those degrading views of labor which drive such multitudes of the young into the genteel professions from a feeling of petty pride.

The connection between idleness and vice is so constant, that statisticians assume it to be phenomenal, and their statements, supported by figures, exhibit a frightful view of its extent and progress. The evils of intemperance, of crime, and of poverty generally, originate with

those who, for want of manual instruction, are unwilling or unable to earn their living by honest industry. And it is to be feared that, unless a general system of industrial training can be extended to all classes, good, bad, and degraded, the best efforts at reformation by individuals will be altogether insufficient to counteract the immoralities engendered by this evil.

These views are not expressed for the purpose of showing that the education provided by the public schools leads to pauperism and crime, as some lugubrious critics have recently discovered. The latest observations of this kind have been directed against the Northern States, especially New England, where the native-born population are nearly all educated, and mostly at the public schools, and among whom I will assume to say there is more general intelligence and less crime than among the same number of people elsewhere on the face of the globe. The friends of industrial education should have no sympathy with the sneers leveled so often at the public school, for it is the most progressive of all our institutions, notwithstanding the opposition of the prejudiced upholders of antiquated methods, and of those who antagonize innovations generally, and particularly the introduction of manual training into the sphere of instruction.

As far back as 1865 the Rev. James Fraser was dispatched from England to the United States for the purpose of reporting to the British Government upon the subject of our common-school system. After stating that the benefits derived from the schools are not so great as is believed in Europe, he adds the following tribute to the general result: "Notwithstanding these hindrances, and if not accomplishing all of which it is theoretically

capable; if lacking some elements which we deem primary, and of which Americans themselves feel and regret the loss, the common-school system is still contributing powerfully to the development of a nation of which it is no flattery or exaggeration to say that it is, if not the most highly educated, yet certainly the most generally educated and intelligent people on the earth."

Since that time the schools have been almost reconstructed without endangering the essential principle of free education. The lacking elements which "Americans themselves regret" have been largely supplied. Normal schools have been instituted, training teachers in the most perfect modes of teaching; the teachers are better qualified and paid, and their social position has become almost equal to a professional one; and men and women of superior attainments are devoting themselves to the new profession. The schools have been graded, the studies enlarged, the art of drawing generally taught, school-books improved, and the system of teaching by rote has fallen into desuetude. The dissatisfaction arising from religious feelings, and the unfriendly strictures of occasional writers, have ceased materially to affect the current of public opinion, unless it be to make the system more perfect, and to open its unrivaled opportunities to the untaught of every class and of every denomination.

It is this reconstructing tendency that is the best hope of the system. Efforts have already commenced, not unsuccessfully, to introduce a limited amount of scientific teaching, and some knowledge of manipulation with tools, and even machines in more than one instance are called in as aids to education. In due course of time some-

thing more will be attempted, and the outlines of industrial science will assume a tangible and permanent place alongside of the fundamental learning in reading, writing, and arithmetic.

I have referred more than once to the deterioration of a people who lose or forget their habits of industry. Of this there are many historical examples. Rome remained mistress of the world until her arts passed into the hands of strangers and slaves. We have another example nearer home, for an unknown race of great intelligence formerly occupied this continent, as is evident from fragments of their arts found throughout the vast regions extending from the Ohio to the Gulf of Mexico. Rings, chisels, knives, and hammers—pottery, vases, and huge earthworks—show that they were miners, manufacturers, and mound-builders. Nothing remains of them but the work of their hands. Their very name is forgotten. Let us hope, however, that a new era has dawned for their barbarous descendants, since an opportunity is now offered the red-man to regain the arts of his unknown progenitors. The educational regeneration of the Indians has commenced at the Hampton Institute in Virginia, and in the Government school at Carlisle, Pennsylvania—the object being to reclaim them from savagery, and to make them students, mechanics, and farmers. At the former of these schools Indian boys and girls are sent by the Government, which pays their fare to and from the institute, and \$150 per annum for each pupil. The balance of the expenses for tuition, board, washing, fuel, lights, and medical attendance for sixty-five Indians, during the year 1881, was \$4,550. The institute, which is a private corporation, looks to individuals and the public to supply

this deficiency. General Armstrong, the founder of the institution, remarks, in his annual report, that a small portion of the money spent during the last five years fighting the Indians would educate them all. What is most admirable in the scheme is that, in addition to elementary teaching, industrial education is accorded an essential place. All must work, and the Indian youths are taught in trades of shoemaking, blacksmithing, tin-smithing, and as carpenters, wheelwrights, and farmers. The girls are quite proficient in acquiring the household arts, and are said to excel in the performance of work for personal decoration, which is but a development of the skill in savage life. As a proof of their aptitude for mechanics, it may be mentioned that all of the tin and sheet-iron utensils used in the school-kitchens are made by two Sioux from the Cheyenne River and Lower Brule agencies, who have become expert tinsmiths in the three years (1882) of their being in the school; and they intend to form a partnership and conduct that business on their reservation. The correspondent in the New York Herald, from whom I gather these facts, has a paragraph in which he states as follows:

I spent the forenoon yesterday in the industrial department of the institution. I found Peters working at a forge, and near him another young man of the same tribe, and about the same age, bending over a wheelwright's bench. The latter's name is Maquimetas, and these two, when they return to their people next year, propose to go into business at their reservation as partners. Peters, however, has evidently a very aspiring temperament, and is reluctant to leave his Alma Mater. He talks of returning to her after his term has expired, in order to go through another three years' course. Pe-

ters and Maquimetas have constructed without any help several wagons and carts, which bear comparison with the work of white mechanics. One of the former, together with some wheelbarrows made by Indian students, has been sent to the Mechanics' Fair at Boston.

And, in describing the general work and object of the institution, the same writer declares that he has given much time to the examination, and was fascinated with the effort. The object of the training is practical knowledge and skill. It is essentially and wisely an industrial school. It is provided with excellent workshops, and three farms are attached to it. Students earn by labor a part of their tuition and board fees. At the same time they gain an invaluable knowledge of their chosen trades. For the Indians, this branch of their instruction is of the greatest importance. The logic of industry is the first thing taught them, and it would be impossible to estimate the prospects of these races when brought under such influences.*

The individual resources of intellect and the fortitude which are developed in the acquisitions of settled society

* "They study or recite from half-past eight in the morning till twelve. From one to six p. m. they work. In the evening there are games, conversation-classes, and religious meetings. The girls are taught to sew, make and mend their own clothes (most of them now can make their own), take cooking-lessons, and do house-work, washing and ironing, as well as our best colored girls. They are particular in washing dishes and setting tables, but are rather slow about it.

"The boys are taught farming, for which most generous provision, by way of a three-hundred-and-fifty-acre farm, has been made by a generous Boston friend.

"Two are learning the printer's trade, four the wheelwright and blacksmith's trade. The fifteen in the Indian shop are at carpentry, shoemaking and mending, and harness-repairing. They make all the tables and tin-

can not be wholly denied to these descendants of the races who manufactured beautiful vases and constructed mounds like that at Cholula. The Cherokees, Menomonees, Winnebagoes, and Six Nations have made a favorable impression upon the people of the United States. Leaving out of question all other efforts to educate and civilize the races still extant, it must be confessed that the effort at Hampton Beach transcends any other in the four centuries since their discovery. It is a message of peace more powerful than all the soldiers in the Western garrisons. The latter will be long necessary for protection, for the growth will necessarily be slow; but a beginning in the right direction, if sustained and persevered in and effectually carried out, can but result in the gradual triumph of our arts and civilization over the whole continent, and among all the races and tribes that inhabit it, and the Indian will yet eclipse all the preindustrial achievements of the great and enlightened races from which he has descended.

Among the evils which are said to prevail in many of the public schools, none is more frequently censured than

ware, and do the small jobs in painting and glazing. Indians have a knack in leather-work. I can show you a one-horse cart and a plain two-story house built by Indian boys.

"Like the girls, they are neat and tidy, but slow. A boy will make a perfect mortise, but is too long about it.

"At first they soon tire, for their muscles are not trained to steady day's work. After two years they are equal to ten hours' labor. But they will not soon get the Anglo-Saxon's gift of endurance or continuousness. They measure larger at the hips, and less relatively at the chest, than whites. All the tinted races seem weak at the lungs, being most sensitive change of surroundings. Consumption is the great enemy."—(*General Armstrong's address in Boston, October, 1880.*)

the cramming process. Newspapers and public speakers have exhausted the vocabularies of invective in showing the nature and extent of the evil, and examples are published from time to time of the sufferings and diseases engendered by over-study. Not long since T. W. Higginson startled the community by an article in the *Atlantic Monthly* upon the "Murder of the Innocents," and public attention was soon afterward called to the death of two pupils, one from brain-fever and the other by suicide, both resulting from mental excitement and too much application to study. Indeed, it is a familiar source of complaint. The evil has undoubtedly been greatly exaggerated, and there is reason to believe that it is often seized upon where the fact does not exist, or as an excuse for deficiency and over-indulgence. But, after making all allowances, its consequences upon the understanding and strength of the pupils can not safely be ignored. The exercise of the intellectual powers is as healthy an exercise as is that of the body, but it is undeniable that over-study in children whose brains and physical system are developing can only be pursued to the serious detriment of their health. In his recent work on the "Diseases of Modern Life," Dr. B. W. Richardson says that the endeavor to fill too hastily the minds of children with artificial information leads to one of two results. Not infrequently in the very young it gives rise to direct disease of the brain itself, to deposit of tubercle if there be a predisposition to that disease, to convulsive attacks, or even to epilepsy. In less extreme cases it causes simple weakness and exhaustion of the mental organs, with irregularity of power. The child may grow up with a memory taxed with technicals impressed so forcibly that it is

hard to make way for other knowledge. Added to these mischiefs there may be, and often is, the further evil that the brain, owing to the labor put upon it, becomes too fully and easily developed, *too firm*, and too soon mature. It remains throughout life a large child's brain, very wonderful for power in a child, but very weak in a man or woman; and the doctor concludes as follows:

"Overwork in the child and in the student defeats its own object. It does not develop the powerful brain so necessary for the man, for life is ever a new and great lesson, and some young brain must be left free for the reception of lesson on lesson. But the danger of overwork is, unfortunately, not confined to the brain; it extends to the body as a whole. When the brain is overworked in the growing child, however well the child may be fed and clothed and cared for, there will be overwaste of substance in proportion to the overwork. There will be stunted growth and a bad physical body."

Now, the practical advantage of industrial education as an antidote to this evil is beginning to attract much attention, and its remedial agencies are particularly invoked to prevent or mitigate the excessive use of one organ at the expense of the entire body. A Boston school committee, appointed for the purpose of investigating the subject, expressed their conviction that the introduction of manual teaching into the school system will serve as an excellent means of preventing over-study. It associates the mental with the material, the exercise of the body with the mind, and thus carries on the symmetrical education of the whole humanity.

One of the best results will be the interest which children take in the nature of objects and in making things;

it will also serve to relieve the mind from, perhaps, dry studies and long tasks and severe discipline, which only disgust and weary them. There is also an especial advantage in training the hand and the eye in some useful vocation that will not only improve the health, but enable the pupils to become self-supporting, independent, and thoroughly competent for the useful duties of life. The partial course of industrial training introduced into some of the schools in Philadelphia as well as Boston have given the most gratifying results. And the superintendent of the Industrial Home School at Washington has stated as a fact that children rarely asked to be excused from school; and, although four half-days in the week were devoted to instructions in various industries, their standard in public-school studies was fully up to the average, proving that a well-arranged system of interchangeable mental and manual training was not only practical, but decidedly advantageous to the pupil. The examination in the various industries taught—practical questions on shoemaking, in gardening, sewing, cooking, house-keeping, carpentering, etc.—presented a novel and interesting innovation upon the conventional examinations in other institutions.

The effect of educated workmanship upon the condition of the worker is a consideration of the greatest importance. We are familiar with the contests of labor. On one side of this interminable controversy it stands grim and hostile, while capital leads the other and generally conquers. By labor in the sense of this conflict I mean those who go through life without any of the superiority or disinterestedness conferred by knowledge or by the habit of thought which knowledge inspires. They

are satisfied to do as they and theirs have always done before them, and so they work and drudge on with a vague presentiment that all improvement in the manufactures or trades in which they toil is hostile to their interests. They belong to a class that would smash machinery or break into strikes when they can result in no benefit to themselves, and which sometimes are followed by proscriptions of those who are guilty of no crime but that of a willingness to work. Educated labor occupies higher ground and understands better the economic relations of industry. He who professes honest, high-minded work, however humble his calling, is inevitably imbued with the spirit he breathes into it, and his mind harmonizes with the execution of its design. He is impressed with a spirit of fairness and justice beyond the comprehension and rough ethics of those less intelligent in his art, and he therefore carries the discipline of study into the exercise of his workmanship under the bright ambition of improving his condition and beholding his children educated to his own standard. A man of less information may vaguely wish for much beyond his reach, and ask for something better in the way of the substantial goods of life, for his labor is wholly task-work. He probably was industrious, honest, and fair-minded originally, but the disadvantages of his situation have insensibly embittered and soured his nature; and his ordinary conversation becomes the vehicle of heart-burnings and jaundiced pictures of realities at all times sufficiently somber. In this state of fostered irritability he toils on in a helpless sort of way, blaming his employer, denouncing capital, and lending himself to plots and cabals which end in breaking the hearts of his family, and leaving his ani-

mal spirits somewhere on the hard track of disappointment and poverty.

But a workman, well informed in the theory of his art, and able and willing to practice it, has higher motives and aspirations; for he is not only sure of the highest wages, but he knows that skill like his paves the road that leads to success, and that the accomplished artisan is sure that his various perfections will be appreciated and rewarded. Indeed, I do not see why, when he is artistic in his skill, he should not rank with those having the impulse of a gentleman, or even with the professional classes, so called.

The application of art to industry until of late years existed only as a tradition. When manufacturing processes were developed in modern Europe, the term utility was made vaguely significant of the arts and devices of mere physical comfort, and the use of art, especially among Anglo-Saxons, was regarded as unimportant, if not frivolous. We are beginning to appreciate its appliance, and few things can now be named in which its graceful touch can be dispensed with. When we contemplate its effect in conducting all branches of industry, as it has been exemplified in Europe and to a less degree in the United States, upon the condition of the workers themselves, it is impossible to conjecture their ultimate progress in social and material prosperity. The painters, sculptors, and architects who made Italy, Flanders, and Germany famous for the higher forms of art at the period of the Renaissance, executed with their own hands designs for carpets, furniture, doors, hinges, and also in metal; and their pieces in bronze, in gold, silver, and in chasing are among the choicest specimens in our art-col-

lections. Guido, Michael Angelo, and Raphael were in the truest sense laboring artists, and did not scorn occasionally to furnish beautiful designs for the decoration of articles devoted to the useful purposes of life. We witness something like this revived. In the finest work of ornamentation the designing is performed by men of culture and long training. The painters in the establishment of the Messrs. Minton receive large salaries for the creations of their pencils upon precious pieces of porcelain, with invaluable delineations outlined upon them, which pass through the world for their beauty.

In a late number (1882) of the "L'Art Revue," two engravings are presented of pieces of furniture that were made in the times of Louis XIV and Louis XVI. They are etched by Léon Goussier, and an editorial remarks that it is only in France that so distinguished an artist would take for his subject a piece of furniture, and not consider it derogatory to his calling. But art is art in France, and the artist never considers any subject unworthy of his pencil. The true artist comprehends art in all its various stages, and he takes the same interest in commonplace subjects when they can translate his ideas into form.

In the United States fine art has not associated with industry. They have seldom moved together. The artist has intrenched himself in a circle that touches no other circumference. But the growing desire for ornamentation, and to bestow the beautiful forms of art upon articles for common use, can only be interpreted as evidence of a great change in public taste, which will ultimately dispel this constant divergence, and bring together these two elements so essential to our progress and refinement.

And, indeed, if the design of higher art is to embellish human existence, why can it disdain to recognize the stupendous interests which spring from the industries of this affluent nation? The desire which stimulates the growing taste for what is beautiful in common things is educating the public mind to appreciate, by a natural adjustment, the finest work of the artist, and to imbue all with a critical knowledge of his creations, and thus to increase his patrons upon an almost incredible scale of magnitude. There is no extravagance of fancy in the belief that art-industry is destined to produce greater results upon the fine arts than the fine arts will ever produce upon it, and that it has already elaborated a taste for them which has not been reciprocated, and which can not hereafter be eradicated. It has produced perfect facsimiles of the finest engravings, and multiplied the works of the great masters, and reproduced the faces and figures of antique art in no respect inferior to the original, at a mere nominal cost; and busts and statues, palaces and cathedrals, spring from the picture-surface according to the optical powers applied to them; and the illustrated newspapers throw off any number of impressions pictorially delineating the main transactions of the great world.

Art-industry, regarded merely in its economics, simplicity, and accuracy, must be considered among the most humanizing accomplishments of mankind. Its relation to the fine arts is only distinguishable as going before them in the necessities of life and in the facilities which it presents to the masses of the people in its various employments and discoveries.

Cultivation refines the sensibilities, and has the same general effect upon all minds. There is a unity, not

only in all the arts, but the same thing is observable in art and science. Each courts the other, and their union is often thought to be indispensable. We know that the same study often involves a science and an art. What could have been known of the laws of chemistry, if the instruments furnished by art had not separated its elements and brought them home to our cognizance? The telescope, the mariner's quadrant, and the air-pump come from the workshop, as do all the instruments of precision which have contributed so immensely to the original stock of human knowledge.

In these instances, and in many others, Science and Art go hand in hand like sisters. The skilled and intelligent working-classes will find that they occupy a much greater share of human enjoyment and honor, and that the line dividing those engaged in the useful pursuits of life from those engaged in intellectual industry will appear less and less in a disadvantageous light. The true, the beautiful, and the good are sources of unfailing pleasure, and the culture of the heart brings a noble recompense which is to be prized more than wealth without the tastes which should accompany it. The man of mental industry and the man of skilled industry stand in a fortunate position, between the sordid rich and the sordid poor, for they possess a consciousness of knowledge and refinement unknown to the possessors of tasteless wealth, or the helplessness of ignorant poverty. The artist, the artisan, the scholar, and the philosopher are advancing slowly but steadily into the world's sympathies and its busy intercourse. They who think and work are the classes that produce the literature of the times, and whose acts will become the history of the future. Study and

the exercise of its arts no longer drift into the eddies of life while the stream of wealth and honor pass by. The artificer of material work and the artificer of thought are engaged in the same object, only in different degrees of effort, but of the same general nature. The difference is between the work of the hand and the work of the brain; and, in comparing the two, the former is rising higher and higher in the scale of intellectual enjoyment, and is assuming consideration socially in proportion to the elements of taste and beauty which it applies to the material conditions of life. Thousands of women trained in our art-schools are rescued from dependence and want, and have learned almost unconsciously that life is worth living; and thousands of men skilled in their calling have been raised to a level of the best educated and the most fully informed of those in commercial or professional life.

Indeed, industrial education is the working-man's best friend and hope in the world; and the advantages which it holds out for his improvement are practically endless. By means of it he may expect not only to realize greater perfection in his work, but also an advance in his social relations; for when art and skill in any direction whatever are developed, they are and must be accompanied by an education of general taste, and an improvement in mind and manners, that will bring him abreast with the best associates in his immediate society.

APPENDIX.

Extract from the Annual Catalogue, 1881-'82, of the School for Manual Instruction of Washington University, St. Louis, referred to in Chapter V.

THE THEORY OF SHOP-WORK.

THE application of the educational idea to mechanic arts is strictly analogous to its application to chemistry and physics. In each, the use of apparatus and the treatment of material is taught by systematic experiments in suitable laboratories. In each, everything is arranged for the purpose of giving instruction in the principles involved, and for acquiring skill in manipulation, and not for the sake of the production of salable compounds of either drugs or apparatus.

Chemical laboratories might be manufactories, and mixtures might be made for sale, but the efficiency of such a laboratory for the purpose of education would be very small. So a manufacturing establishment can be made a place for instruction in the use of tools, but its cost would be great in proportion to its capacity, and the variety of work would be limited by its business.

SPECIAL TRADES ARE NOT TAUGHT.

The scope of a single trade is too narrow for educational purposes. Manual education should be as broad and liberal

as intellectual. A shop which manufactures for the market and expects a revenue from the sale of its products, is necessarily confined to salable work, and a systematic and progressive series of lessons is impossible, except at great cost. If the object of the shop is education, a student should be allowed to discontinue any task or process the moment he has learned to do it well. If the shop were intended to make money, the students would be kept at work on what they could do best, at the expense of breadth and versatility.

It is claimed that students take more interest in working upon something which, when finished, has intrinsic value, than they do in abstract exercises. This is quite possible, and proper use should be made of this fact; but if all education were limited to such practical examples, our schools would be useless. The idea of a school is that pupils are to be graded and taught in classes; the result aimed at being, not at all the objective product or finished work, but the intellectual and physical growth which comes from the exercise. Of what use is the elaborate solution in algebra, the minute drawing, or the faithful translation, after it is well done? Do we not erase the one, and burn the other, with the clear conviction that the only thing of value was the discipline, and that that is indestructible?

So in manual education, the desired end is the acquirement of skill in the use of tools and materials, and not the production of specific articles; thence we abstract all the mechanical processes and manual arts and typical tools of the trades and occupations of men, arrange a systematic course of instruction in the same, and then incorporate it into our system of education.

Thus, without teaching any one trade, we teach the essential mechanical principles of all. In accordance with the foregoing principles, the shop-training is gained by

regular and carefully graded lessons designed to cover as much ground as possible, and to teach thoroughly the uses of ordinary tools. This does not imply the attainment of sufficient skill to produce either the fine work or the rapidity of a skilled mechanic ; this is left to after-years. But the knowledge of how a tool or machine should be used is easily and thoroughly taught. The mechanical products or results of such lessons have little or no value when completed, and hence the shops do not attempt to manufacture for the market.

As has been said, work of immediate utility is of greater interest to students than abstract lessons. Such work has an undoubted value, and is in many ways desirable, provided it does not hinder or interfere with regular instruction. Opportunities for such constructive work are constantly occurring. The wants of a large institution are many, and when they can be supplied by student skill it is a benefit to all concerned. In this way, outside the stated hours, pupils have the means of applying their knowledge and of gaining additional practice. The yearly aggregate of such productions is quite large, and it affords undeniable evidence of the efficiency of systematic instruction.

DETAILS OF SHOP-INSTRUCTION.

The shop-instruction is given similarly to laboratory lectures. The instructor at the bench, machine, forge, or anvil executes in the presence of the whole class the day's lesson, giving all needed instructions, and at times using the black-board.

When necessary, the pupils make notes and sketches, and questions are asked and answered, that all obscurities may be removed. The class then proceeds to the execution of the task, leaving the instructor to give additional help to such as need it.

At a specified time that lesson ceases, the work is brought in, commented on and marked. It is not necessary that all the work assigned should be finished ; the essential thing is, that it should be well begun and carried on with reasonable speed and accuracy.

It is almost useless to say that the personal characteristics of pupils are even more marked in this work than in any ordinary recitation, from the fact that no text-books are used, nor is there previous study. The length of time required by different pupils in a large class for the doing of a specified piece of work varies considerably. Hence additional lessons or constructive work is arranged for the brighter and quicker members.

Work in the blacksmith-shop is in one essential feature different from any other kind. Wood or cold iron will wait any desired length of time while the pupil considers how he shall work ; but here comes in temperature, subject to continual change.

The injunction is imperative to "strike while the iron is hot," and hence quick work is demanded—a hard thing for new hands.

To obviate this difficulty bars of lead are used, with which the lesson is first executed, while all the particulars of holding and striking are studied. The lead acts under the hammer very nearly like hot iron, and will permit of every operation of the blacksmith-shop except welding. Much is anticipated from its use as a preparation for the working of iron, as each lesson is first executed in lead.

One of the most difficult lessons in the art of the smith is that of managing the fire. The various kinds of heat are explained and illustrated, and habits of economy of both iron and fuel are inculcated.

HOW THE USE OF TOOLS IS TAUGHT.

Frequent requests have been made for detailed descriptions or drawings of the models actually used in the several shops. Such requests have generally been refused, for several good reasons. In the first place, the main object of one or more lessons is to gain control and mastery of the tool in hand, and not the production of a particular model. The use of the tool may be well taught by a large variety of exercises, just as a knowledge of bank discount may be gained from the use of several different examples. No special merit can be claimed for a particular example; neither can a particular model or series of models have any great value. No good teacher is likely to use precisely the same set twice.

Again, the *method* of doing a piece of work, and not the finished piece, may be the object of a lesson. To illustrate: Directions are given to a class in carpentry to saw a piece of wood, holding it upon the bench-dog. A pupil is found attempting to do the work holding it on a trestle. On being corrected, he insists that he can't do it so well in that way. The teacher replies, or should reply, "Then that is the way you should do it, until you can do it well." Now, the exercises by which certain methods of using tools are to be taught, often depend upon varying circumstances, such as the quality of the material, the age of pupils, and the pupils' knowledge of working drawings. Instead of giving particular descriptions of exercises, we prefer to state the general methods by which the use of the various tools is taught.

The tools are not given out all at once; they are issued as they are needed, and to all the members of the class alike.

In carpenter-work the tools used are the cross-cut, tenon, and rip saws, steel square, try square, bevel and gauge, hammer, mallet, knife, rule and dividers, oil-stones, and slips ; and of edge-tools, the jack- and smoothing-planes, the chisels and gouges. Braces and bits, jointer-planes, compass-saws, hatchets, and other tools, are kept in the shop tool-closet, to be used as needed.

The saw and the plane, with the square and gauge, are the foundation tools, and to drill the pupils in their use numerous lessons are given, varied only enough to avoid monotony. The pupil being able to plane a piece fairly well and to keep to the line in sawing, the next step is to teach him to add the use of the chisel in producing simple joints of various kinds. The particular shapes are given with the intent to familiarize the pupil with the customary styles and methods of construction.

The different sizes of the same tool—chisels, for instance—require different care and methods of handling, and the means of overcoming irregularities and defects in material form another chapter in the instruction to be given.

With the introduction of each tool, the pupils are taught how to keep the same in order. They are taught that sharp tools are absolutely necessary to good work ; to make them realize this is a most difficult task.

TURNING.

In a general way, much that has already been stated applies to wood-turning. Five or six tools only are used, and, from previous experience, the pupils know how to keep them in order. At first a large gouge only is issued, and the pupils are taught and drilled in its use in roughing out and producing right-line figures ; then convex and concave surfaces ; then in work comprising all these—all in wood-

turning with the grain. A wide chisel follows, and its use in conjunction with the gouge is taught.

After this a smaller gouge, chisel, and parting tool, and a round-point are given, and a variety of shapes are executed. Next comes turning across the grain; then bored and hollow work; next, chucking, and the various ways of manipulating wood on face-plates, chucks, mandrels, etc.; finally, turning of fancy woods, polishing, jointing, and pattern-work.

Of the course in iron-work, nothing must as yet be said, for the reason that we desire to speak only of work gone over, and that department is not yet fully developed.

THE ORIGIN AND PURPOSE OF THE SCHOOL.

The Manual Training School owes its existence to the conviction, on the part of its founders, that the interests of St. Louis demand for young men a system of education which shall fit them for the actual duties of life, in a more direct and positive manner than is done in the ordinary American school.

We see, in the future, an increasing demand for thoroughly trained men to take positions in manufacturing establishments as superintendents, as foremen, and as skilled workmen. The youth of to-day are to be the men of the next generation. It is important that we keep their probable life-work in view, in providing for their education. Excellent as are our established schools, both public and private, it must be admitted that they still leave something to be desired; they do not, and probably they can not, cover the whole ground.

It is believed that, to all students, without regard to plans for the future, the value of the training which can be got in shop-work, spending only from four to twelve hours

per week, is abundantly sufficient to justify the expense of materials, tools, and expert teachers.

It is very well understood that many students can not wisely undertake the full course of intellectual study now laid down for the regular classes of a college or polytechnic school. It occasionally happens that students who have special aptitudes in certain directions, find great difficulty in mastering subjects in other direction. In such cases it is often the best course to yield to natural tastes, and to assist the student in finding his proper sphere of work and study. A decided aptitude for handicraft is not unfrequently coupled with a strong aversion to and unfitness for abstract and theoretical investigations.

There can be no doubt that, in such cases, more time should be spent in the shop and less in the lecture and recitation room.

One great object of the school is to foster a higher appreciation of the value and dignity of intelligent labor, and the worth and respectability of laboring-men. A boy who sees nothing in manual labor but mere brute force, despises both the labor and the laborer. With the acquisition of skill in himself comes the ability and the willingness to recognize skill in his fellows. When once he appreciates skill in handicraft, he regards the workman with sympathy and respect.

In a manual training-school, tool-work never descends into drudgery. The tasks are not long, nor are they unnecessarily repeated. In this school, whatever may be the social standing or importance of the fathers, the sons go together to the same work, and are tested physically, as well as intellectually, by the same standards. The result in the past has been, and in the future it will continue to be, a truer estimate of laboring and manufacturing people, and a sounder judgment on all social problems.

APPENDIX SECOND TO CHAPTER V.

“THE Imperial Technical School of Moscow is a high-class special school, principally intended for the education of mechanical constructors, mechanical engineers, and technical engineers.

“The school consists of two divisions, general and special, each of which has a course of three years. The special division is divided into three branches—mechanical construction, mechanical engineering, and technological engineering.

“The three years’ course of the general division embraces the following subjects : Religion, free-hand and linear drawing, descriptive geometry, general physics, zoölogy, botany, mineralogy, chemistry, geodesy, analytical geometry, higher algebra, differential and integral calculus, general mechanics, drawing of machine-parts, the French and German languages, i. e., all scientific subjects, the previous knowledge of which is required from the pupils of all the three following branches.

“In the special department, the three years’ course of the three branches contains the following subjects : Organic and analytical chemistry, metallurgy, practical physics, mechanical and chemical technology, technics of wood and metals, analytical mechanics, construction of machines, practical mechanics, railway construction, engineering and constructive art, projecting and estimating of machines, works, and mills, industrial statistics, and book-keeping.

“A fourth division is designed exclusively for the education of foremen (*contremaîtres*), and is called the Practical Section. It is reserved for pupils who have received

good marks for conduct and for manual work, but whose theoretical attainments are insufficient for the requirements of the third class. Instead of passing into this, they are put in the Practical Section, where much more attention is paid to workshop practice. The whole duration of their studies is then only three years.

“Every one of the appointed sciences is taught fully, or in a condensed form, according as it is considered a fundamental or collateral subject of the given branch. The students of all the classes are occupied during a stated time in practical work in the laboratories and mechanical workshops.

“Admission into the school as boarder or day scholar is obtained by competitive examination, in accordance with the ordained programme.

“Pupils who have passed through the full school course of the gymnasiums may be admitted without further examination to the lectures of the second general class of the school, but pupils of the last class of the gymnasiums, who have not passed their final examinations, are admitted only to the first general class of the school.

“The pupils wear the appointed half-military uniform.

“Pupils who have obtained in the school the appointed grades receive acknowledged rights in the service of the government.

“The school is maintained by funds from the following sources : Percentage on funded capital,* fees of private boarders and foreign hearers, and profits received from the mechanical works.

“The annual receipts of the school amount to \$160,000.

“The annual expenses of the school amount to \$140,000.

* The school capital amounts to about \$2,030,000.

“The technical school is under the immediate patronage of their Imperial Majesties.

“*Auxiliaries to Instruction.*—The school possesses a special library, containing more than six thousand volumes of works on specialties, a cabinet of physics, two chemical laboratories, a cabinet of mechanical models, a cabinet of natural history, extensive mechanical works with separate smithy and foundry, and also school workshops.

“No one will deny that a close acquaintance with hand labor, and, in general, practical experience in mechanical works, are matters of the utmost importance to every engineer.* The drawings of an engineer thus trained will always be distinguished by solidity and that practical judgment which is the result not only of the study of scientific truths, but also of the acquirement of a certain familiarity in their application to practice. That the knowledge of hand-labor is of extreme importance to a young man devoting himself to technical activity, and that it is considered an absolute necessity to him, we are convinced by the circumstance that the greater number of the polytechnic schools of Western Europe demand from the students who enter them either a previous stay, of a certain duration, at some works of industry, or issue to them a diploma, attesting their accomplishment of the course, after they are in position to show that they have been occupied practically for a definite period at some such works on their leaving the school.†

“If we contemplate the matter itself more profoundly, and acquaint ourselves more closely with the circumstances

* We speak here of mechanical engineers and constructors.

† This statement is decried by Professor Ludwig, of the Munich Polytechnic School, than whom no man is in a better position to judge.

of the practician at private works and mills, we must, disregarding exceptional cases, since it is not those which form the rule, arrive at the sad conclusion that a young man, desiring to acquire practical experience in a short time, and without the aid of an experienced guide, loses, at private works, nine tenths of his whole time entirely unprofitably. As we are at present addressing persons well acquainted with this matter, we do not consider it necessary to bring forward arguments in support of our statement. The practical information acquired in works by a young man before entering a polytechnical school is very inconsiderable, and therefore does not possess the desired significance.

“Such information is, on account of its defectiveness, of little assistance in promoting the study at school of practical mechanics—the construction of machines, or the drawing up of plans and estimates for mills and works.

“A young man on leaving a polytechnic school should endeavor to carry on his practical education; should fix upon some mill or works in which, being, in the majority of cases, of course, left to his own initiative, he may find place and opportunity for his further self-education.

“At this moment, so critical in the career of the youthful engineer, the insufficiency of material resources is the cause that the majority take service, at a very low rate of remuneration, as draughtsmen in the drawing-office of mechanical works, or in the drawing-offices of railway companies; others, more fortunate, enter works in the quality of artisans; but even they are hardly to be envied, simply from the fact that in the majority of cases the specialty of the first works which they happen to enter becomes their own specialty through life. An experienced observer will find no difficulty in perceiving all the inconveniences to a technical education which arise as the result of such an order of things. Let us explain this by examples: A young

man, having received thorough scientific preparation in a polytechnic school, has entered as artisan practician some extensive joiner-works, and in a year or two begins to serve in the capacity of a workman, receiving pay from the works. If, from any circumstance whatever, he becomes deprived of his place, he finds it necessary to seek another in a similar joiner-works, or else to enter again as practician in another specialty, for instance, a locomotive, boiler, or other works. The material resources of young men preclude, in the majority of cases, the possibility of their deciding on the latter alternative.

“If the observant directors of polytechnic schools should take upon themselves the work of following the industrial career of the contingent of their pupils who on leaving school enter a drawing-office, they would easily perceive that those young people experience extreme difficulty, when they are once engaged there, in leaving such an office, and in the majority of cases remain draughtsmen all their lives. In such offices a young man acquires but very inconsiderable technical information, neither can they in any way serve him as practical schools for his further self-instruction. And we must here observe, also, that the more extensive the works, and consequently the drawing-office attached, the fewer are the advantages offered to the young practician, since he has to do with an institution in which division of labor, forming an essential principle, will not admit of his becoming speedily acquainted with the general progress of work. We can not but add that this principle, having become latterly extensively applied in all large works and mills, though on the one hand bringing considerable material advantages to the proprietors, has, on the other, greatly influenced the depreciation of the level of technical knowledge among the workmen, by confining that knowledge within the limits of narrow specialization.

“The technical education afforded to young men in almost all the polytechnic schools of Europe leaves, theoretically speaking, little to desire, but is exceedingly imperfect practically, and demands the particular attention of those persons who are intrusted with such instruction.

“The peculiar circumstances by which the young people who have finished the course of the polytechnicums find themselves surrounded do not admit, before their entering upon an active life, of the acquirement of even a superficial general practical education, but place them in the necessity of devoting all their activity from the first day of their leaving school, and often their whole life, to a narrow specialty. The attention of the directors of polytechnic schools has often been drawn to this, and attempts have frequently been made to familiarize young people at school with the practical work of mechanics, but all these endeavors have proved to be unattended with success, from the following reasons :

“1. The school-workshops for the practical occupation of the students were constructed on a very miniature and inconsiderable scale.

“2. The consequent want of room in these workshops did not admit of all the students being occupied at the same time, and therefore their attendance was not obligatory, while the majority of the professors and masters expressed their disapprobation of such employment.

“3. There existed no systematic method of practical instruction in the workshops similar to that which had been applied to the practical teaching in the chemical laboratories.

“4. The material resources assigned for the maintenance of the school-workshops were very inadequate.

“5. The time allowed for the full course of study in the polytechnic schools was insufficient to admit of the

combination, in that course, of theoretical with practical instruction in technology.

“Though [before the year 1873] there had appeared some literary articles against the introduction of practical instruction with workshops into the higher technical schools, yet it is our subjective opinion that those articles appeared only in defense of the existing order of things, and to justify a certain lukewarmness in introducing advantageous measures, but no demonstration of the results of trial were afforded among the arguments against such a mode of instruction, for the simple reason that, excepting feeble attempts, no serious experiments had [then] been made. Even those attempts themselves were made without any particular energy and due observation.

“We do not here take into calculation some of the at present existing technical schools of France, which possess sufficiently extensive school-workshops,* because those schools belong rather to the lower-class technical institutions, and do not give to the world mechanical engineers and constructors, but only foremen (*contremaitres*).

“The slight acquaintance of learned technologists with practical work in mechanical workshops entails the unfortunate consequence that, in the greater number of even very extensive works, the practical part remains in the hands of routined artisans, who have received no scientific instruction, but who have attained their exceptional position by accustoming themselves during the course of many years to the most obsolete methods of practice in the mechanical art.

“The Imperial Technical School of Moscow, the course of which, from the theoretical subjects taught therein, equals the course of many of the polytechnic schools of

* These are the schools of Chalons, Aix, and Angers.

Western Europe, combines theoretical with practical education, and consequently is enabled to present real proofs of the possibility and advantageousness of such combination, since the trial of this combination has been made on an extensive scale, and during a considerable length of time.

“For the practical education of young men in the two branches—mechanical engineers and mechanical constructors*—the school possesses large mechanical works with hired workmen, accepting and carrying out orders from private individuals and on a commercial footing, for the construction of steam-engines, working-engines, pumps, transmission apparatus, agricultural machines, etc.†

“The works consist of the following shops: Joiners’ shop, engineers’ shop, erectors’ shop, painters’ shop, a large forge with steel hammer and fan-blast, iron-foundry with furnace for three thousand kilogrammes of metal, and brass-foundry; the works have also a drawing-office and counting-house attached to them.

“A steam-engine of thirty horse-power is used for the working of the place, while the foundry, with fan-blast and coal-pulverizing mill, is worked by an engine of ten horse-power.

“The works are under the management of the head mechanical engineer [M. Malicheff], and his assistant, Platonoff, mechanical engineer. The drawing-office is in the charge of M. Gans, mechanical engineer. . . .

“These works, being within the walls of the institution itself, and managed by well-instructed technologists, would

* Young men studying the technological engineering branch are admitted to the laboratories instead of the mechanical workshops.

† These works execute private orders to the sum of from \$35,000 to \$40,000 annually.

be of important assistance in the instruction of young people, even if the young people took no active part in the practical working of them.

“But, in order that the pupils may derive the greatest possible advantage from such auxiliaries, the school possesses, apart from the mechanical works and intended solely for the use of the pupils, school-workshops, a joiners’ shop with turning-lathe, pattern-shop, metal turning, fitters’ shop, smithy, and molding-shop.

“Every one of these shops is under the management of a technologist, specialist, or of a skilled workman, and their duty is to instruct the pupils in the rudiments of mechanical labor.

“Every young man becomes acquainted, by fulfilling the obligatory programme, with all the work of mechanical art, namely, turning, fitting, carpentering, and forging, in the school-workshops, and only then is admitted to the mechanical works.

“We shall endeavor to speak further on the system of teaching the arts in the mechanical workshops of the school.

“Up to the present time, throughout the world, the workmen at industrial works and mills are usually self-taught. Any one who has himself been employed at works, and is familiar with the daily life of the workman in the different countries, must have perceived that the acquirement of knowledge and skill in any trade is to him a process much similar to the following: A boy of thirteen or fourteen years of age having entered a mechanical works to learn his trade, is put, during the first few years, to work of an entirely unproductive kind, and which has not the slightest relation to technics. He is made to carry water, sweep the workshop, crush emery, grind colors, etc. Only after the lapse of a few years, and, probably, thanks to accidental circumstances, a chisel or a file is put into the hands

of the youth and he is set to perform the rudest and simplest kind of work.

"Then, also, if he happen to have neither father nor brother among the workmen around him, he begins learning his trade without a guiding hand, and thus commences acquiring practical knowledge and skill in his trade by observing those about him in the workshop and by his own thought and calculation, and impelled by the sole desire of attaining, in as short a space of time as possible, the position of a paid hand in the works. There can be no doubt that under such circumstances the acquirement of skill by the new generation of workmen takes place in an extremely irrational manner, and without any system; the amount of knowledge obtained depends upon accident, and the time thus employed is of disproportionate length. Besides this, there is yet another inconvenience, namely, that of specializing labor to too fractional a degree. The young workman, placed accidentally at a drilling or planing machine or a self-acting lathe, endeavors to remain as long as possible at his machine, encountering, it will be understood, no objection on the part of the heads of the workshops, since such specialization of labor redounds to the advantage of the proprietors, owing to the abundance of hands.

"This order of things has the deplorable result that, notwithstanding the long-continued stay of the young workmen at mechanical works, which is sometimes prolonged through the major part of the years of their manhood, well-taught and skilled fitters are almost everywhere rarely to be met with. This will be confirmed by all those constructors who demand skilled labor for the erection of models, and of the more or less delicately constructed instruments, machines, and apparatus.

"During the past few years endeavors have been continually made to open schools for the instruction of the

workmen at all works of any considerable extent. The subjects taught in these schools are free-hand and linear drawing, arithmetic, and many others, in the supposition that practical knowledge of works will be acquired in the works themselves.

“From this it is impossible to conclude otherwise than that society, while taking measures to civilize the working-classes, gives, at the same time, no attention whatever to the manner in which the young workmen acquire practical experience in their trades at the works ; no endeavors have been made in that respect, and meanwhile, in our opinion, the question is worthy of particular attention.

“The conclusion, however, forces itself upon us that this question can hardly be entered into until the young well-taught technologists, leaving polytechnic schools, shall themselves possess rational experience in practical hand-labor. In order that their education as specialists shall be full and ample, such knowledge is indispensable in the highest degree, though, until the present time, it has unfortunately presented a prominent deficiency in their instruction. Who will not admit that the knowledge of the manner of executing given work is a necessity to one who has to issue the project of such work ?

“Acting on the principle that mechanical engineers and mechanical constructors, whose future activity will be devoted pre-eminently to mechanical works, should have practical experience in the mechanical arts, the Imperial Technical School has employed every necessary measure for the solution of this difficulty in the best possible manner.

“In 1868 the school council considered it indispensable, in order to secure the systematic teaching of elementary practical work, as well as for the more convenient supervision of the pupils while practically employed, to separate

entirely the school-workshops from the mechanical works in which the orders from private individuals are executed, admitting pupils to the latter only when they have perfectly acquired the principles of practical labor.

“By the mere separation of the school-workshops from the mechanical works, the principal aim was, however, far from being attained; it was found necessary to work out such a method of teaching the elementary principles of mechanical art as, firstly, should demand the least possible length of time for their acquirement; secondly, should increase the facility of the supervision of the gradationary employment of the pupils; thirdly, should impart to the study itself of practical work the character of a sound, systematic acquirement of knowledge; and, fourthly and lastly, as should facilitate the demonstration of the progress of every pupil at every stated time. Everybody is well aware that the successful study of any art whatsoever, free-hand or linear drawing, music, singing, painting, etc., is only attainable when the first attempts at any of them are strictly subject to the laws of gradation and successiveness, when every student adheres to a definite method or school, surmounting, little by little, and by certain degrees, the difficulties to be encountered.

“All those arts, which we have just named, possess a method of study which has been well worked out and defined, because, since they have long constituted a part of the education of the well-instructed classes of people, they could not become subject to scientific analysis; could not but become the objects of investigation, with a view of defining those conditions which might render the study of them as easy and regular as possible.

“This, however, can not relate to those arts which have been hitherto pre-eminently followed by the common and imperfectly educated class of work-people, but a knowledge

of which appears at the present moment to be of importance to the educated technologist.

“These arts are : wood-turning, carpentering, metal-turning, fitting, and forging. From what we have already said, it will not be difficult to arrive at the reason of the absence of a strictly systematic method for the study of them, nor why the active working out of such a method, without the aid of enlightened minds, may long remain deferred.

“Meanwhile, the necessity of such a method, more particularly for technical educational establishments, admits of not the slightest doubt, and the filling up of this want promises evident advantages, not only in the matter of scientific technical education, but also with regard to the practical instruction of the work-people, and consequently the perfection of mechanical hand-labor itself, which, from the introduction of specially adapted machinery, is, year by year, perceptibly deteriorating.

“If we except the attempts made in France, in the year 1867, by the celebrated and learned mechanical engineer, A. Clair, to form a collection of models for the practical study of the principal methods of forging and welding iron and steel, as well as the chief parts of joiners’ work, and this, with a purely demonstrative aim, no one, so far as we are aware, has hitherto been actively engaged in the working out of this question in its application to the study of hand-labor in workshops. To the Imperial Technical School belongs the initiative in the introduction of a systematic method of teaching the arts of turning, carpentering, fitting, and forging.

“To the knowledge and experience in these specialties of the gentlemen intrusted with the management of the school-workshops, and to their warm sympathy in the matter of practical education, we are indebted for the drawing

up of the programme of systematic instruction in the mechanical arts, for its introduction in the year 1868 into the workshops, and also for the preparation of the necessary auxiliaries to study. In the year 1870, at the Exhibition of Manufactures at St. Petersburg, the school exhibited its methods of teaching mechanical arts, and from that time they have been introduced into all the technical schools of Russia.

“The auxiliaries of education employed in teaching mechanical arts were exhibited at the International Exhibition of Vienna and that of Philadelphia, in order that specialists in these matters might become acquainted with them.

“The auxiliaries of education appointed for the teaching of any mechanical work whatever—for example, fitters’ work—are classed in three categories ; to the first of these belong the collections of instruments employed in fitters’ work, with which the beginner must make himself perfectly familiar before entering upon work, and afterward to use these instruments during the execution of the work itself.

“To this category relate all those collections of models indispensable to the teacher of fitters’ work, for the purpose of demonstration : the collection of instruments most in use for measuring, full size ; the collection of instruments, full size, for drilling metals ; the collection of instruments, full size, for finishing, from the smithy to the fitting-shop inclusive.

“Models of files, increased to twenty-four times the ordinary size, for the purpose of demonstrating the surface of the incision ; the collection of models of instruments employed in cutting screws and nuts, increased six times ordinary size, for the study of the direction of the angles of incision ; the collection of models of drills, increased six

times, for the practical study of the cutting angles ; and, lastly, the collection of instruments and apparatus for teaching the tracing of yet unworked metal articles. We consider it our duty to draw the attention of specialists to this last collection, for the organization of which we are indebted to our skillful instructor of fitters' work, Mr. Savetkin, mechanical engineer.

“ To the second category belong the collections of models appointed for the systematic and gradationary study of hand-labor in the fitter's art. These collections have the same signification with regard to the work of fitting as is allowed to scales and exercises in instruction in music. They are so ordered that the beginner may be enabled to overcome by certain gradations the difficulties which present themselves before him. It will be sufficient to glance at the adjoined detailed list of objects contained in these collections, and to examine attentively every object exhibited, to be convinced ; and if the pupil, under the guidance of the teacher, carefully fulfills the study of all the numbers embraced in the collections, or rather the educational programme of the art of fitting, he must inevitably, and in the most rational manner, render himself familiar with all the known practical hand-labor of this art.*

“ Hence we arrive at the conviction, without any difficulty, that with such a system of teaching the supervision of the teacher over the pupils, and his observation of their

* In the apprentice classes each student is not obliged to complete every number in the programme ; but the work is nevertheless so divided that he becomes familiar with each piece. While a student is making, for example, No. 2, his right-hand neighbor is working on No. 1, and his left-hand neighbor on No. 3, so that he sees how each one is made. He is obliged, moreover, to listen to the explanations which the instructor gives to his neighbors, and is himself afterward examined on them. The pupils in the practical section are, however, obliged to make every piece on the list.

progress, become exceedingly easy. He need only remark that every number of the programme is executed satisfactorily by the pupils, and, putting the following one before him, give the requisite explanations for the succeeding work.

“In such a case, the fact of a great number of pupils being occupied at the same time will present no great disadvantage, nor will it increase the arduousness of his duty to any considerable degree. And, further, it will be a matter of impossibility that a pupil who has been working during a few years in the workshop should fail to be able to use the drill, or to trace a part to be worked, though he handle satisfactorily the chisel or the file.

“To the third category belongs the collection of those articles, or parts of machines, in the execution of which all the practical hand-labor of the fitter’s art is successively repeated, having been acquired during the studies of the previous course.

“What we have said in relation to the manner of study of the work of fitting must be accepted also with regard to the other branches of labor, namely, wood-turning, carpentering, smithy, and foundry-work. . . .

“In conclusion, we consider it our duty to observe that ten years had [in 1873] already elapsed since the programmes of instruction in the mechanical arts were introduced into the workshops of the school, and they have been found to attain in the most brilliant manner the aim proposed in their introduction.

“VICTOR DELLA-Vos.”

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